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CONTENTS

FIRST PART: ORIGINAL ARTICLES

GIUSEPPE DR. GIOVANNI. — The Selection of Cereals in Italy

SECOND PART: ABSTRACTS.

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

LEGISLATIVE AND ADMINISTRATIVE MEASURES. — 608. Legislative measures adopted by the Republic of Colombia for Agricultural and Live-stock Development.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES. — 609. Agriculture and Live-stock in the Spanish Gharb (Morocco).

RURAL HYGIENE. — 610. Observations on a North American Species of *Scaphium* and their possible Action in disseminating Infectious Diseases. — 611. An Experimental Study of Pellagra in Mississippi, United States. — 612. Brewer's Yeast as a Source of Vitamins.

AGRICULTURAL INSTITUTIONS. — 613. The Bureau of Applied Botany attached to the Scientific Committee of the Russian Ministry of Agriculture and its first ten years of Work (1874-1914).

II. — CROPS AND CULTIVATION.

a) GENERAL.

PHYSICS, CHEMISTRY AND MICROBIOLOGY. — 614. The Presence of a Wet repelling Film on the Surface of Particles of Sand and Mould. — 615. The Movement of Soluble Salts with the Soil Moisture, Experiments at Utah, United States. — 616. The Alkaline Reaction produced by Acids in Soils, viewed from the Standpoint of Plant Nutrition. — 617. Experiments on the Growth of *Azobacter*. — 618. Sterilisation of the Soil by Dry Heat. — 619. Texture of the Soil in Java, Determined by Mohr's Method of Mechanical Analysis.

MANURES AND MANURING. — 620. Injurious Effect of Farmyard Manure on the Balance of Nitrogen in the Soil. — 621. On the Capacity of White Mustard to Fix Nitrogen and Liberate the Soil. — 622. Investigations into the Fertilisation of Phosphates in Russia. — 623. Chemical Composition of "Potassic Ash"

b) SPECIAL.

- AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS. — 624. Edible Mushrooms in Hungary. — 625. Manganese in Wheat. — 626. Investigations into Vegetable Diseases: Results and Problems. — 627. Influence of Hydrogen Peroxide on Germinating Seeds. — 628. Fluorine in the Vegetable Kingdom.
- PLANT BREEDING. — 629. Comparative Tests of 3 Varieties of Rye at Torstorp, Sweden. — 630. Comparative Tests of 9 Varieties of Oats at Torstorp, Sweden. — 631. Cross-fertilization in a Wild Crucifer and a Cultivated Crucifer with Tubercled Root. — 632. Breeding of Crops in Iowa, United States.
- CEREALS AND PULSE CROPS. — 633. Wheat Varieties in Siberia. — 634. Growing Maize in the Haute-Marne, France. — 635. A Remarkable Cultural Variety of Rye in the Upper Valley of Dora Riparia, Italy. — 636. Influence of Methods of Sowing Oats on the Yield; Experiments in Russia. — 637. Trials of different Varieties of Malt, at the Royal School of Agriculture of Caltanissetta, Italy. — 638. Particulars of Rice-growing in Sumatra.
- STARCH CROPS. — 639. New Method of Economic Cultivation of the Potato.
- FORAGE CROPS, MEADOWS AND PASTURES. — 640. *Cytisus sphaerocarpus* as Winter Forage.
- FIBRE CROPS. — 641. The Cotton Plant in the Russian Empire. — 642. Cultivation of *Clitoria grandiflora* in the State of Rio de Janeiro, Brazil.
- CROPS YIELDING OILS, DYES AND TANNINS. — 643. Queensland-grown Copra. — 644. Sesame growing in Sicily.
- RUBBER, GUM AND RESIN PLANTS. — 645. Thinning out *Hevea* Plantations.
- SUGAR CROPS. — 646. Relative Richness of a few Kinds of Sugarcane in Queensland, Australia. — 647. Absorption and Loss of Nitrogen in Java Sugarcane Plantations after Manuring with Sulphate of Ammonia or Nitrates.
- STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS. — 648. Judging the Quality of Tea from certain characters. — 649. Coffee-tree Grafting in Java. — 650. Trials of Hop cultivation in Italy. — 651. The Principal Problems in relation to Medicinal Plants and their Active Principles.
- HORTICULTURE. — 652. How to Obtain an Early and Abundant Crop of Tomatoes.
- FORESTRY. — 653. Composition of Fallen Leaves of Forest Trees and their Quantities. — 654. Investigations of Tree Seeds in Relation to the Place of Origin of the Parent Tree and their Descent and Experiments on the Preservation of the Principal Forest Tree Seeds. — 655. The Genus *Juniperus* and its Commercial Importance. — 656. The proper Season for Application of Fertilisers to *Cryptomeria japonica* and *Chamaecyparis obtusa* and the Efficacy of the Former. — 657. Value of Eucalyptus Wood as Fuel; Experiments in the State of San Paulo, Brazil. — 658. Commercial Development of Forests in British India.

III. — LIVE STOCK AND BREEDING.

a) GENERAL.

- HYGIENE. — 659. Emphysarcosis (*Emphysarcotum sicum* Foth), a new Vaccine for the Treatment of Symptomatic Anthrax. — 660. Tests with Salvarsan in the Treatment of Anthrax; its Influence on the Formation of Antibodies in the Blood of Horses. — 661. The Virulence of the Blood of Animals suffering from Epizootic Foot-and-Mouth Disease.
- ANATOMY AND PHYSIOLOGY: GENERALITIES. — 662. Experimental Studies of Castrolium: its Effects on Oxygen Exchange of the Tissues.
- FEEDS AND FEEDING. — 663. Investigations into Nutritional Deficiency. — 664. Trade in Commercial Foods for Livestock in Uruguay.

CONTENTS

v

b) SPECIAL

- BARBERS. — 665. Horse breeding in Italy in 1914. — Strength of Sands.
CATTLE. — 666. Requirements for Advanced Registry of Cattle Breeds in the United States.
— 667. Regulations adopted by the Argentine Rural Society for Registering Milk Records of Dairy Cows.
SHEEP. — 668. The Fleece of Russian Coarse-woolled Sheep.
SILKWORKS. — 669. Experimental Rearing of the Silkworm in "Euboea", in Southern Italy.

IV. — FARM ENGINEERING.

- AGRICULTURAL MACHINERY AND IMPLEMENTS. — 670. Official Trials of Tillage Machines in France. — 671. A Cooperative Society for Machine Ploughing. — 672. Quickly Detachable Plough Shares. — 673. Slow-speed and High-speed Motors. — 674. New Method for the Detection of Unexploded Shells in the Field. — 675. Review of Patents.
LANDING CONSTRUCTION. — 676. Hydraulic Fill Method Used to Throw a Temporary Dam across a Wide Stream. — 677. A Dry Boat Stabilizer.

V. — RURAL ECONOMICS.

- Influence of the Size of Farms on their Grass Yield.

VI. — AGRICULTURAL INDUSTRIES.

- INDUSTRIES DEPENDING ON PLANT PRODUCTS. — 678. Natural Wheat Bread.
INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — 679. Chemical Comparison between two Fermented Milk Products: the "Labananch" of Egypt and the "Mammouri" of Syria.
— 680. Fine and Coarse Wool of Russian Sheep. — 681. The Variety of Bee wax and the Substances used for its Adulteration.

PLANT DISEASES.

I. — GENERAL INFORMATION.

- LEGISLATIVE AND ADMINISTRATIVE MEASURES FOR THE PROTECTION OF PLANTS. — 682. Ordinance relating to Insect Pests and Diseases of Plants in Western Samoa. — 683. Decree including the "Abruzzi grape" (*Vitis vinifera* L.) among Protected Products in Uruguay.

II. — DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- Factors Contributing to the Lodging of Wheat. — 686. "Sarkani" Disease in the "Marvel of Peru" (*Mirabilis jalapa*). — 687. "Spoke" Disease in Sambla, in India.

III. — DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

GENERALITIES. — 654. Vegetable Parasites of Cultivated or Useful Plants observed in the Government of Tula, Russia. — 689. Behaviour of Different Forms of *Rhizoctonia solani*. — 690. Relation of Stomatal Movement to Infection by *Cercospora beticola*. — 694. Wintering of *Oidium* sp., a Pest of *Phodinia serrulata* in Emilia, Italy. — 695. The History of *Eriosacus deformans* (Peach leaf Curl) and Preventive Treatment.

MEANS OF PREVENTION AND CONTROL. — 693. Action of Copper Sulphate on Vine Mildew.

DISEASES OF VARIOUS CROPS. — 694. A New Disease of Germinating Wheat caused by *Uromyces horicella* sp. in Salt Lake Valley. — 695. *Bacillus Sorghi* on *Andropogon Sorghum* in Salt Lake Valley, Utah. — 696. Sweet Potato Diseases in the United States. — 697. Scurf (*Monilochaetes infuscan*) of the Sweet Potato. — 698. Phytophthora Diseases of Ginseng in the United States and in Japan. — 699. *Thielavia basicola*, a new Pest of the Melon in Salt Lake Valley, Utah. — 700. An *Oidium* Mildew on Carnations, in Europe. — 701. *Pleospora Briostiana*, *Phomopsis Cocchi*, *Macrophoma Yuccae* and *M. Cinnamomifolia*, new Microfungi discovered in Liguria, Italy. — 702. Brown Rot (*Sclerotinia cinerea*) of Prunes and Cherries in North-West Region of the United States. — 703. A new Asiatic Species of *Gymnosporangium*, established in Oregon.

IV. — WEEDS AND PARASITIC FLOWERING PLANTS.

704. Investigations in 1913 on the Weeds occurring in the Government of Kherson, Russia. — 705. Experiments for Control of *Ranunculus arvensis*, a Weed infesting Wheat, in Tunisia.

V. — INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

GENERALITIES. — 706. Two new British Coccidae and other British Species Injurious to Plants.

MEANS OF PREVENTION AND CONTROL. — 707. *Prospaltella berlesae* against *Diaspis padana* in Piedmont in 1915. — 708. The Life History and Control of the Vine Moths *Conchylis ambigua* and *Polychrosis botrana*; Observations made in 1914, by the Plant Disease Observatory of Turin, Italy. — 709. Tobacco Juice for the Treatment of the Vine Moths *Polychrosis botrana* and *Conchylis ambigua*, in Piedmont. — 710. Method of Coccidial Control used in Germany. — 711. Destruction of the Tobacco Beetle (*Lasioderma castaneum*).

INSECTS, ETC., INJURIOUS TO VARIOUS CROPS. — 712. *Colletes angustatus*, a Cynipid Injurious to Sorgho and other Graminae in India. — 713. *Agodis segetum*, Beet and Potato Pest in Germany. — 714. Nature of the Damage caused by the "Pink Boll-Worm" (*Anthonomus gossypivella*) to the Cotton Shrub in Egypt. — 715. *Zellaria oleastrella* and *Glyphodes aenealis*, Lepidopterous Pests of the Olive Tree in Apulia, Italy. — 716. The "Catalpa Sphinx" (*Ceratoma catalpa*), a Lepidopteron infesting *Catalpa catalpa* and *C. speciosa*, in the United States. — 717. The "Parsnip Webworm" (*Depressaria herachana*), an Insect Enemy of the Parsnip, in Canada. — 718. The "Cherry Leaf Beetle" (*Galerucella cerasi*), a Fruit Tree Pest, in the United States. — 719. Morphology and Biology of the "Golden Apple Aphis" (*Aphis pomi*), in the United States. — 720. *Platypus Wiltoni*, a New Species of Coleopteron, attacking Coniferous Trees in British Columbia.

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The Editor's notes are marked (Ed.).

FIRST PART
ORIGINAL ARTICLES

The Selection of Cereals in Italy

by

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of the Italian Ministry of Agriculture

This article deals in particular with the work of selection and hybridisation carried on in various agricultural institutions in Italy.

1. — "R. STAZIONE SPERIMENTALE DI GRAMINCOLTURA" AT RIETI

In 1903 there was founded, at Rieti, a "Cattedra sperimentale di graminicoltura" (Chair of experimental cereal culture), converted later, by the law of the 6th June 1907, into the "R. Stazione sperimentale di graminicoltura". It was from the outset, and is still, directed by Professor NAZZARENO STRAMPPELLI, whose name was already known in connection with important hybridisation work begun in 1897.

At the Rieti Station, he first and foremost took in hand the improvement of the well-known "Rieti" wheat which, though held in high esteem owing to its rust resisting powers, was nevertheless of poor cropping value, being very liable to lodge. Having observed that resistance to lodging depends on the number, arrangement and shape of the vascular bundles in the culm (1), Prof. STRAMPPELLI satisfied himself that he would be unable to attain the object in view by means of selection alone, without neglecting pedigree selection, therefore, he took up the work of hybridisation, which seemed to him indispensable in order to combine in a new variety of wheat the two qualities: resistance to rust and resistance to lodging. The results obtained by hybridisation, in contrast to those yielded by pedigree selection, enabled him to state that, with sufficient patience and

1. *Rendiconti della R. Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*. EXTRACT from Vol. XVI, 1st Half-year, Serie V, Part 2, Meeting of the 26th January 1907. Experiments on the selection and hybridisation of wheat and maize. — Note by Dr. N. STRAMPPELLI.

perseverance, the desired object can undoubtedly be secured on this method. He is far from denying that with pedigree selection there may be the likelihood of obtaining excellent kinds, but this thing is chiefly possible when the investigations bear upon a material not new to stock; in other terms, a material in which spontaneous cross-fertilisation may have taken place. Such cross-fertilisation, though not possible, it is true, in wheat cultivated under normal conditions, is on the other hand anything but rare when southern kinds of wheat are cultivated in countries which are too northerly for them, and where excessive cold and moisture may readily lead to the atrophy or sterility of their anthers. Therefore, the desired result can only be attained with certainty by hybridisation; a proof of which may be found in the fact that the celebrated Institute of Svalöf, the birthplace of pedigree selection, has in some years now resorted to hybridisation to make good the deficiencies found when the matter was left to chance.

In the extensive experimental fields placed at the disposal of Prof. STRAMPELLI since the foundation of the "Cattedra sperimentale", the work of selection and improvement of "Rieti" wheat, and other varieties, was undertaken along three different lines:

- 1) Physiological and methodical selection of the "Rieti" wheat.
- 2) Acclimatisation (assisted by selection) of the best foreign kinds in the Rieti plain, with a view to imparting to them rust-resistant qualities.
- 3) Hybridisation between different species and varieties with a view to fostering variations, in order to fix new types or kinds of wheat superior, in rust and lodging resistance and in yield, to the kinds previously obtained.

The crosses made with successive generations yielded by segregative many thousands of forms, the most interesting of which are being studied, and where possible, fixed. Prof. STRAMPELLI has also obtained a number of new types of maize, which are being studied and fixed as far as possible.

The Station has at present 3 experimental fields under different meteorological conditions:

- 1) Rieti Field, in a locality the climate of which is made very moist by the abundant fogs and the spring and summer dews. The chief object here is to produce types of wheat resistant to rust and lodging, and at the same time capable of the highest yields, especially in the valleys of central and southern Italy.
- 2) Field of Foggia, where the aim is to produce wheats and oats that will thrive in the arid climate of Apulia.
- 3) Field of Leonessa (at about 1000 metres altitude) intended for the production of new varieties of wheat, barley, rye and other cereals suitable for cultivation in hilly and mountainous regions.

In the investigations carried out on these three experimental fields the method by selection of the "small species" according to the idea of JORDAN, and the method by hybridisation were followed. Table I gives the pure pedigrees of some of the most important wheats.

TABLE I. — *Pure Pedigrees of some Important Wheats*

	Pedigrees kept	Pedigrees definitely discarded	Pedigrees not under trial
"Rieti"	8	4	112
"Gentil Rosso"	81	1	12
"Shiro" \times "Cologna"	1	1	1
"Mairea"	1	1	1
Various soft wheats	23		
Various pollard wheats	15		
Various hard wheats			

Total 141

Among the pedigrees which were kept, some, which constantly gave excellent results, are highly interesting. There may be mentioned, for example:

1) A "Rieti" designated as number 745, which, for several years, showed resistance to lodging, and a productivity superior (as much as 6 to 7 $\frac{1}{2}$ bushels per acre) to those of the original "Rieti", and all the other pedigrees of this stock isolated.

2) A "Gentil Rosso", numbered 6, more rust-resistant and constantly more productive (4 $\frac{1}{2}$ to 6 bushels per acre) than the original type from Montevarchi and the other pedigrees of this kind isolated by the Station.

3) Two pollards (1 "White pollard" known as "Petandile" and 1 "Red pollard"), which, though the grain produced was of inferior quality for bread-making, gave, in 1912, the exceptional yield of 81 bushels per acre.

In all, up to the end of 1914, 273 crosses were carried out between native and foreign wheats, and from them were obtained 1,288,024 possible types according to the calculations of the probable groupings of the autogamous characters of the parents. Among these types there were taken in hand 4,776, of which 3,600 were discarded in the course of several years, so that at the end of 1914 there remained, including the crosses last created, 1,086 forms under study, some of which have given good results for several years and are at present being grown in bulk. In the very first rank are the following:

1) "Gregor Mendel" Wheat, designated as No. 144 among the 250 types obtained by the cross "Rieti" \times "Principe Alberto". It is resistant to rust and lodging, and yields as much as 52 bushels per acre.

2) "Carlotta Strampelli" Wheat, type No. 647, among those obtained from the cross "Rieti" \times "Massy". This wheat, rust and lodging-resistant, gives yields exceeding 70 bushels of grain per acre.

Among the drought-resistant wheats, particular mention must be made of "Dauno" (a hard wheat), "Gargano" (a soft beardless wheat), and "Apulia" (a soft bearded wheat) resulting from the cross "Rieti" \times "Spalt white bearded".

Before distributing these last 3 wheats, they must again be submitted to fresh tests in order to establish their merits beyond dispute.

Prof. STRAMPELLI has also endeavoured to produce early varieties and has already obtained important results.

For wheat, in addition to crosses between different varieties he has also made crosses between species and even between different genera.

The crosses shown in Table II are examples :

TABLE II. — *Principal Crosses between Different Species or Genera.*

<i>Triticum turgidum</i> × <i>T. durum</i>	<i>T. dicoccoides</i> × <i>T. villosum</i>
<i>T. durum</i> × <i>T. polonicum</i>	<i>Aegilops ovata</i> × <i>T. villosum</i>
<i>T. sativum</i> × <i>T. spelta</i>	<i>T. polonicum</i> × <i>T. villosum</i>
<i>T. sativum</i> × <i>T. dicoccoides</i>	<i>T. sativum</i> × <i>Aegilops trix.</i>
<i>T. sativum</i> × <i>T. amyllum</i>	<i>T. sativum</i> × <i>A. ventricosa</i>
<i>T. sativum</i> × <i>T. villosum</i>	<i>T. sativum</i> × <i>Sacale cereale</i>
<i>T. amyllum</i> × <i>T. villosum</i>	<i>Hordeum nutans</i> × <i>H. bulbosum</i>

These crosses yielded not only many interesting observations from the scientific standpoint, but likewise practical results, such as the creation of new species, namely :

Triticum giganteum, with very large ears, bearing grains almost equal in size to the coffee berry.

Triticum furcatum, which bears long prong-like awns similar to those of *Hordeum furcatum*.

Prof. STRAMPELLI is also conducting investigations in respect to the following cereals :

1) *Barley*. — There have been obtained about 170 new kinds of the very highest value, one of which, particularly productive, attained in 1911 a yield of 73 bushels per acre on the elevated plateau of Leonessa.

2) *Oats*. — From the cross *Avena sativa* × *A. fatua* there were obtained about 200 new types, some of them very promising as regards productivity and above all as regards power to withstand the dry climatic conditions of the region of Foggia.

3) *Maize*. — Various crosses made with a view to obtaining very early and very productive kinds, with reduced vegetative growth, have yielded an exceedingly large number of new types, of which about 300 are at present under observation; some of them ripen at Rieti about the middle of August, and have given yields of 47 to 50 $\frac{1}{2}$ cwt. per acre.

4) *Rye*. — This is also being studied, but no noteworthy result can be mentioned as yet.

The work of the Station of Rieti has been extended to other plants also, namely : pulses, potatoes, pumpkins, tomatoes, certain woody plants, etc.

We may add that Prof. STRAMPELLI endeavours not only to give the new kinds an indisputable cropping value, but also, when possible, to impart

peculiar characters which may distinguish his creations. Thus, for instance in addition to the wheat "Carlotta Strampelli", he has obtained the greyish-green lentil, two-coloured potatoes, lucerne with white flowers with iron-grey flowers, greenish flowers, etc.

In view of the good results obtained at the Station of Rieti with some of these varieties of wheat, the Ministry of Agriculture in 1915 established under the direction of Prof. STRAMPELLI several experimental fields in different regions as adjuncts to agricultural institutions in Central and Southern Italy, in order to compare the varieties produced at the above Station with other wheats under extensive cultivation. The results of these comparisons pointed everywhere to the following conclusions:

1) The wheat "Carlotta Strampelli" exceeded all others with regard to yield (30 to 50 bushels per acre).

2) The wheat "Carlotta Strampelli" is the one most resistant to lodging, and to rust and other fungoid diseases.

Although the above results have been carefully checked, Prof. STRAMPELLI, before distributing this important quality of wheat to the public, will next season repeat the tests in the various regions, in order to determine the best time for sowing and the most suitable quantity of seed for each of the different localities.

The work thus briefly reviewed was accomplished in less than a year, and has earned well-deserved praise from well-known scientific agriculturists and scientists, among whom mention may be made of LUDWIG PHILIPPE VILMORIN, who hold a very favourable opinion on the work of Prof. STRAMPELLI.

In addition to its work of selection, the Rieti Station has carried out a series of important investigations and experiments relating to the following questions: manures, rust diseases, parasites of cereals, transplanting of cereals, preparation of cultures of root bacteria of the French Honeysuckle (*Hedysarum coronarium*), etc.

II. — "SOCIETÀ ANONIMA COOPERATIVA BOLOGNESE PER LA PROMOZIONE DI SEMENTE DELLA GRANDE COLTURA". — On the initiative of Professor TODARO and under the auspices of the Society of Agriculture of the province of Bologna, the foundations were laid in 1908 of an "Istituto di allevamento delle piante agrarie" (Institute for agricultural plant breeding), directed by Prof. TODARO himself. The object of this Institute was to conduct selection work for the special purpose of "individualising a very small number of kinds of wheat best calculated to meet the requirements of cereal cultivation in the province of Bologna".

As the fundamental guiding line for his work, Professor TODARO adopted the idea of "small species", "physiological" or "JORDAN" species, which leads to the chief importance being attributed to the first process of sorting out, the latter having of course, at the out-set of the work, to be made in ordinary cultivated fields. On the whole, Prof. TODARO follows the method of pedigree selection practised at Svaföl, and afterwards proceeds to the selection and pure cultivation of the types presenting most value.

After the work of selection had successfully accomplished its first

phase, in July 1911, the above Limited Cooperative Society of Bologna was formed for the production of seeds for extensive cultivation, and in the agricultural year 1912-1913, the seeds resulting from the first growth were obtained on a commercial scale. In the following years, there were fixed and grown many wheats of the types of: "Rieti", "Cologna", "Masolino", "Bordeaux", "Gentil Rosso mutico", "Gentil Rosso rustato", "Inallettibile" (Non-lodging), "Turgido d'Australia" (Austrian rivet).

The separation and breeding are now accomplished facts and growing in bulk on a commercial scale has already been undertaken: in 1914 the Society sold more than 49 tons of seeds, and its members took 29 tons.

With a view to promoting the spread of physiologically selected races in Latium, and introducing in that province the varieties esteemed elsewhere, the Ministry of Agriculture instructed Professor TODARO to make similar trials of selection and adaptation in that region; they were begun in the agricultural year 1913-1914 by isolating and breeding 255 lines of wheat and 192 of oats derived from local cultivations on the Hopkry method, as well as "cinquantino Pelò" maize and "Pignoletto" maize for poultry, and finally by instituting some trials for adapting to ordinary cultivation, "Kirsche" oats, "Saragolla" wheat, 1 rivet wheat, 3 types of "Rieti" wheat, and 2 wheats of the "Cologna" type -- physiologically pure races obtained by the above Society.

From the best of the progeny the material was derived with which, in 1913-1914, the trial breeding was begun for the choice of the best lines, which in their turn are being subjected in 1915-1916, partly to a production test, and partly to a regional test. From the results obtained hitherto, the following conclusions may be derived:

1) In a short time, there will be placed at the disposal of farmers in Latium, a small number of physiologically pure races of wheat suited to the environment, characterised by high productivity and by resistance to rust and lodging.

2) The best type of the common "Avena romana" will soon have been segregated.

3) Next year it will be possible to hand over for bulk cultivation 2 valuable pure races of maize: one with grains very rich in starch, specially suitable for feeding cattle; the other with grains rich in gluten, particularly adapted for human food.

Finally, Prof. TODARO proposes to assist in extending the cultivation of brewers' barley by segregating the lines which will have been found most appropriate to the Roman Campagna.

III. -- "R. STAZIONE AGRARIA", MODENA -- At this agricultural Station, wheat selection work was begun in 1910, and is still continued under the direction of Prof. G. LO PRIORE and his assistant, Dr. G. D'IMPOLITO.

The method of pure lines is adopted, observing the following principal points:

1st year: First choice of the parent heads, in a common field.

THE SELECTION OF CEREALS IN ITALY

2nd year: Comparative tests of the progeny of these heads, the grain of which is sown and cultivated separately.

3rd year: Cultivation in bulk of the selected progeny.

The initial selection of the heads took into account the cropping power and resistance to rust and lodging, and was made from the following wheats: "Gentil Rosso", "Rieti", "Cologna Veneta", "Poliese", "Colognese del Modenese", "Noè", "Shiriff", "Rosso Clona", "Quattrocoste", "Majorca rosso". Altogether 200 heads were chosen and the grain sown on 200 plots of 1 square metre to the number of 50 per plot. After the heads were ripe, the number of families reckoned as good was reduced to 10 only, namely: 1 "Gentil rosso", 1 "Quattrocoste", 2 "Rieti", 1 "Poliese" and 3 "Cologna Veneta".

In 1912 these families were subjected to the first trial growth in bulk; then, in 1913, a second bulk trial was made and good results were obtained as regards yield of grain. In 1914 a third bulk cultivation was made discarding the "Poliese" wheat, which showed insufficient resistance to rust and had not come up to the expectations based on the results of previous years (though it must be remembered that in 1914, throughout Italy, the season was unfavourable to grain formation). In 1915 only the "Gentil rosso" was cultivated in bulk, and was found very promising. On the other hand, the "Rieti" and "Cologna", holding out little prospect of success, were definitely abandoned. At present 10 families of standard hybrid wheats are being bred, which were marked out in a group of 100 of the previous year, and from which good results may be expected.

In addition to the wheat selection trials, tests are in progress for the acclimatisation of different kinds of Scotch wheat and oats; these will serve as the point of departure for other work.

IV. — "R. SCUOLA SUPERIORE DI AGRICOLTURA" MILAN. — In the higher School of agriculture, selection is studied and practiced by Prof. UGO BRIZI and Dr. B. VENINO.

In his studies, Prof. BRIZI devotes himself specially to phenomena of cleistogamy and parthenogenesis, together with their consequences in applied genetics. Other work in progress has for its object to solve (if this can be done with precision) the question of the inheritance of acquired characters, by means of a clearly proved natural process. The results hitherto obtained may be considered as excellent and will be published after renewed checking.

Special attention has been paid to the Cruciferae and the Chenopodiaceae in the course of the breeding work, all the cleistogamic and parthenogenetic forms being studied and tested under cultivation on the Nilsson method, thus completing that aspect of the latter's experiments which was rather defective.

In addition, some forage Gramineae and different kinds of wheat, oats, and brewers' barley are being studied.

For several years, study has also been carried out on some Leguminosae, on the phenomena of segregation of hybrids produced artificially, on the Mendelian method, but here again, to give the results any value

particularly in reference to DE VRIES' mutations, the observations must be continued for ten years at least.

Dr P. VENINO has, since 1910, been making experiments of selection with "Rosso Olona" wheat, on the NILSSON method.

After making some thousands of observations, he was able to separate 2 families, the characters of one of which began rapidly to approximate to those of the "Quattrocoste" wheat, while the other varies continuously and also exhibits awnless ears.

During the last season many bulk plots were laid out, yielding as a result, in the case of the "Rosso Olona" wheat, high tillering power, strength of straw, and weight of grain. In the successive cultivations the weight and bulk of the grain has increased continuously.

In short, Dr VENINO has struck out the right path for improving the wheat "Rosso Olona", and, by taking his rigorously conducted experiments as a basis, he has every reason to hope that this wheat will be a thorough success (1).

V. — "R. ISTITUTO SUPERIORE AGRARIO SPERIMENTALE", PERUGIA.
Prof. ALESSANDRO VIVENZA, the director of this higher Royal Institute for Experimental Agriculture, began his selection experiments in 1900.

For 6 years past he has been carrying on a methodical selection of the wheat "Fucense semiduro". Started on the Nilsson method, it proved that, in the progeny of a given plant, there were marked differences between individuals of the same family, to such an extent that this phenomenon could not be ascribed wholly and solely to the segregation of characters according to Mendelian laws; for this reason it was thought advisable to continue selection on a method approximating to that of HALLER and it was found that this wheat, which is a young strain, might be capable of very marked modifications, exactly as the Darwinian theories would suggest. This observation appears to be confirmed by the results of another experiment made with the "reversible Vilmorin Wheat".

VI. — "R. ORTO BOTANICO E GIARDINO COLONIALE", PALERMO.
This Botanical and Colonial Garden, under the direction of Prof. A. BOKZI, has, since 1900, also devoted a part of its activity to work in connection with the selection of some varieties of cereals, beginning with barley (2), on which Dr TROPEA has been working for several years with very encouraging results.

Fresh researches and experiments are proceeding for the purpose of isolating a Sicilian race of wheat resistant to seasonal changes; other studies cover the following: Coefficient of density — Influence of origin of seeds on acclimatisation — Enquiry into inheritance of recently acquired characters — Influence of time and depth of sowing on drought resistance and on the yielding powers of wheat, barley and oats.

(1) Cf. Dr. P. Venino: 1) "Di alcuni ibridi Garton", in *L'Agricoltura moderna*, Year 1907, Nos. 42 and 43. — 2) "Cereali di primavera", *Ibid.*, Year 1908, Nos. 51 and 52. — 3) "Prime notizie intorno ai lavori di selezione del frumento "Rosso Olona", in *Annuario Padua*, Vol. XI, 1912-1913, and Vol. XII, 1913-1914.

(2) Cf. C. Tropea: "Risultato di colture selezionate, 1. *Hordeum sativum*", in *Bollettino del R. Orto botanico e Giardino coloniale*, Year VIII, Part 4, Palermo, Tip. Priulla, 1909.

VII. — "R. SCUOLA PRATICA DI AGRICOLTURA", ANDRIA (BARI). For the selection of wheat, undertaken in 1913, Prof. L. VIVARELLI, director of this Practical School of Agriculture, has mapped out a plan directed to improving local varieties and to proving whether, in the droughty climate of this region, varieties from other regions can be acclimatised. The predominating local variety is "Bianchetta di Puglia", and the varieties introduced from elsewhere are: "Gentil rosso", "Noë", "Rieti" and "Vilmorin reversible Wheat".

As regards the local variety, a short period of systematic selection was applied to begin with, then pedigree selection was adopted, taking the parent heads from a field containing the individuals produced by the systematic selection. At present, after having in the first year chosen the parent heads, the first phase of the second period has been reached, i.e., the beginning of pedigree selection, which is to be followed in the third year by bulk cultivation of the selected progeny.

In any case a first important conclusion may be derived from these tests, namely, that the safest plan is to take in hand the already existing local strains.

In future tests, Prof. VIVARELLI will not only continue the work of pedigree selection, but will also carry forward his moulding up trials, which, in conjunction with physiological selection, have already proved to be the fundamental means for obtaining the new strain of wheat which shall best correspond to the local conditions of climate and soil, and solve the important problem of abundant wheat production.

VIII. — "ISTITUTO AGRARIO VIGANI", PARUTIO (AREZZO). By means of the wheat selection carried out on the estate of the above Agricultural Institute, its director, Prof. DANTE VIGANI has been able to raise the average yield of grain from 17.58 to 25.03 bushels per acre.

Since 1912-1913 he has made it his task to produce by selection a type of "Gentil rosso" more resistant to lodging and thus to contribute, by careful and assiduous work, to increasing the grain production of that region.

Prof. VIGANI did not confine his experiments to wheat, but extended them successfully to the following plants: oats, maize, beetroot, turnips, hemp, tobacco and forage plants.

IX. — "ISTITUTO AGRARIO" DI SCANDICCI (FLORENCE). The Senator Prof. PASSERINI, founder and proprietor of this Agricultural Institute, has, since 1900, conducted hybridisation tests on the wheat "Gentil rosso", and has been able to show that the proclivity of this variety to lodgings due to the structure of the culm, this latter having very thin walls, relatively large air space, and remarkable diameter of fibres in the outer sheath (1). To remedy this drawback, he tried crosses between "Gentil rosso" and "Noë" and obtained a number of forms of "Gentil rosso" x "Noë" and "Noë" x "Gentil rosso". The first of these crosses yielded 50 new forms of which

(1) Cf. "Ricerche ed esperienze istituite nel poli-sperimentale e laboratorio di chimica analitica e nell'osservatorio meteorologico, sotto la direzione del prof. N. Passerini" in *Politecnico dell'Istituto agrario di Scandicci*, Year 1915, Florence, Tip. G. Ramella & Co.

only 9 were sown separately. From their progeny 4 forms were isolated, which resisted lodging admirably.

Prof. PASSERINI is of opinion that, in order to preserve the characters of the new varieties, careful selection must be made every year.

It is an established fact, in any case, that agriculture in Tuscany has derived appreciable benefit from the work of selection conducted by the investigator.

X. "STAZIONE SPERIMENTALE DI RISICOLTURA", VERCELLI (PIEDMONT). This Station for Experimental Rice Cultivation, is under the direction of Prof. NOVELLO NOVELLI. It possesses a field for pedigree selection of rice intended specially for acclimatisation tests of new imported varieties, and pedigree cultivation of some varieties to be improved. It has a small meteorological station at which daily observations are made of climatic conditions, the vegetative behaviour of the different varieties of rice and corresponding phenomena, the results being afterwards collated for a series of years.

Prof. NOVELLI endeavoured to produce a first practical improvement of rice by the following means: affording rice-growers the collaboration and technical advice of the Station; making known good methods of cultivation; inspecting and directing cultivation; and distributing graded seeds to the most intelligent rice-growers. The result has been that some rice-growers have specialised in the production of pure rice seeds for supplying the market.

The advantages derived from the foregoing by Italian rice-growers have been, and continue to be, most marked, and they will still further increase when the production of pure seeds has been facilitated by the system of transplanting introduced into Italy some years ago with highly promising results. This system obviates spontaneous reproduction of seeds prematurely dropping on the ground owing to various causes, and a pure product is thus secured. Physiological selection has retained and accentuated the best characters of the varieties imported from Asia of late years, which would certainly have degenerated failing this attention. Such was the case, for instance, with the variety "Chinese originario" or "Abbondanza" imported twelve years ago, which now furnishes $\frac{2}{3}$ of the Italian crop. It has been possible to maintain its cropping and disease-resistant powers, and even to improve its marketable qualities.

The continued selection operating on one and the same variety has yielded earlier types, particularly suitable for cold and shady waters and soils, and, for later sowing, types with larger grain, longer, and richer in gluten, of higher commercial value, which in a short time became fairly widespread, to the considerable advantage of Italian rice cultivation.

For 3 years the Station of Vercelli has carried on pedigree selection of rice in order to restore the qualities of pure lines to some of the best varieties, namely:

1) Variety "Chinese" or "Bertone", imported from Asia about 1821 into the State of Piedmont: very early, of high commercial value but insufficiently productive and with a limited yield of polished grain.

THE SELECTION OF CEREALS IN ITALY

2) Variety "Ostiglia": has lost a good deal of its resistance to disease and lodging; limited production, limited yield of polished grain; on the other hand it is fairly early and of excellent marketable quality.

3) Variety "Chinese originario" or "Abbondanza": the best of those recently imported, cultivated over very wide areas, highly productive, resistant to the different diseases, but less now than formerly; on the other hand it ripens late, is easily lodged and of limited commercial value.

Among these 3 selections begun, the most promising is that of the "Chinese originario". Next year the selection of the 2 first varieties will be resumed and that of 4 or 5 esteemed varieties will be begun. Afterwards, hybridisation of pure varieties will be experimented with.

The Station of Vercelli also intends to organise importation and acclimatisation of new varieties of rice as soon as it has the necessary means.

It may be concluded that this Station, despite its exceedingly limited means, has within a short time furnished brilliant proof of its capacity.

Conclusions. From what we have set out, and from what has been published in Italy in relation to the improvement of cultivated plants, the following conclusions may be drawn:

1) In Italy considerable sums have been spent on controlling plant diseases, but very little for direct improvement of plants.

2) The experiments of selection and hybridisation of wheat begun in 1900 took on continuous form in 1905.

3) The Royal Station of Rieti for cereal cultivation has obtained significant results, confirmed by all regional tests carried out disinterestedly and with the utmost care by various State Agricultural Institutes; it has furnished a valuable contribution to genetics in general, and to cereal cultivation in particular.

4) The Cooperative Society of seed producers of Bologna has isolated and fixed numerous families of wheat in pure strains, which it has spread through certain parts of Italy, particularly Emilia.

5) The Schools of practical agriculture at Scandicci and Banullo have obtained and spread in Tuscany varieties of wheat of higher yield and more resistant to lodging.

6) In the following establishments: the higher Schools of Agriculture of Milan and Perugia, Royal Colonial Garden of Palermo, Royal Agricultural Station of Modena, and School of Agriculture of Andria important studies and experiments are being carried on which have for their object the progress of cereal cultivation, particular attention being given to local varieties of wheat.

7) The Vercelli rice cultivation Station has in a few years rendered valuable service to agriculturists, and has brought to a successful conclusion important work appreciated by Italian and foreign scientists.

8) As in other departments, Italy has distinguished herself in that of the improvement of plants under extensive cultivation, and in that of the application of the biological and chemical sciences to the problem of seed supply.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

LEGISLATIVE
AND ADMINISTRATIVE
MEASURES

668 - **Legislative Measures adopted by the Republic of Colombia for Agricultural Livestock Development.** — I. Ley 75 de 1915 (20 de noviembre) por la cual se fomenta la agricultura nacional, in *República de Colombia, Diario Oficial*, Year LI, No. 12, pp. 1715-1716, Bogotá, 184 December 1915. — II. Ley 82 de 1915 (30 de agosto) por la cual se fomenta el establecimiento de carnicerías y refrigeradores (Diario Oficial para la exportación de carnes. *Ibid.*, No. 15 659, p. 1762, December 2, 1915).

I. — Under the first law above cited, the object of which is to foster national agriculture, there will be founded, *inter alia*, Stations of scientific agriculture in suitable localities of the Republic, with the object of carrying on study and scientific experiments; demonstrations bearing on the application of chemical manures, and the cultivation and acclimatisation of plants; and also of organising exhibitions of modern agricultural implements and machinery (article 1). — Each Station will have a special department for : agricultural meteorology, agricultural entomology, analysis of soil, water, introduction and distribution of useful seeds and plants, and acclimatisation of chemical manures and breeding animals in order to improve strains; in short, all that is necessary for the development and progress of national agriculture (article 3). A monthly organ will be issued, *El Cultor Colombiano*, which will give an account of the work at the Stations, furnish other general agricultural information, which consuls abroad likewise required to transmit (art. 6 and 8). The Ministry of Agriculture and Commerce will also organise at Bogotá, industrial, agricultural and livestock exhibitions for 3 years, and further, similar exhibitions will be held every 2 years in the chief towns of departments, at the expense of the latter (art. 9). There will likewise be founded, as soon as possible, a central Institute of Bacteriology in connection with the Stations of scientific

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

in agriculture, thus carrying into effect law 72 of 1914 (art. 10). Model farms may be established in the 3 climatic zones (hot, temperate and cold) in Colombia (art. 11).

II. — The object of the second law is to encourage the establishment in Colombia of meat packing-houses and chilling works for the exportation of cold-stored and canned meat. The plant and machinery imported by these establishments for the exclusive purpose of slaughter and preparing and preserving the meat will be free of import duty, this exemption remaining in force for 2 years from the beginning of exportation. Establishments will pay the departments in which they are located only 10 *centavos* (about 5*d*) per animal slaughtered, instead of the usual slaughtering tax, and will be exempted from all export duties which might be imposed by the Colombian Government, for a period of 20 years from the promulgation of the present law (art. 1). The establishments must be provided with the necessary destructors and disinfecting plant, in order that day by day the offal may be burned or converted into manure (art. 3). Finally, the Government will undertake a census of the cattle in Colombia as soon as possible.

III. **Agriculture and Livestock in the Spanish Gharb (Morocco).** VASQUEZ, José, in *La Industria pecuaria*, Year XVII, Nos. 80-83, 1917, and *Estadística Agrícola*, 1917, pp. 850-853, Madrid February to April 1, 1918.

I. *Soil.* The Spanish Gharb comprises the districts of Arcila, Larache and Alcazarquivir. The rich zones of Gharbia, Aïxa, El Jolot and Tilig, which have an area of about 932 square miles, form part of it. The country is chiefly hilly, the plain being limited to the river valleys. The soils are: 1) mellow alluvial in the valleys; 2) sandy, reddish yellow in colour, on the hills and mountains; rich in humus and excellent for cereal growing; 3) marshy or briny in the valleys of Maharihar and Haxet and near the mouth of the Oûad-Trahahart (these extensive marshes are known under the name of Tembladeras) and in the valleys of Oûad-Mejazen, Oûad Onarou, &c. All these lands are rich in organic matter, with high capillarity, permeable and hygroscopic; they are easily worked. The analysis of 2 soils: A from the valley of Lucens, B from the sandy slopes of the Smid el Ma made in the Agricultural Institute of Madrid, yielded the readings shown in the following table.

Physical and chemical composition of 2 soils from the Spanish Gharb (parts per thousand).

Physical analysis	A Valley of Lucens	B Sandy slopes of Smid el Ma
Moisture	21.00	12.10
Organic matter	6.00	10.00
Limestone	146.00	5.50
Coarse sand	1,000.00	1.00
Fine sand	360.00	1,000.00
Clay	200.00	20.00

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

Chemical analysis of the soil dried
at 100° C.

	A	B
Nitrogen	0.99	1.37
Phosphoric acid	2.03	1.07
Lime	83.71	5.00
Potash	1.62	0.03

II. *Climate*. Moist and temperate; this zone comes within the region of cultivation of the olive tree, in its southern subdivision.

III. *Vegetable Products*.—1) *Cereals*. The wheats cultivated are chiefly *Triticum polonicum*, and to a much less extent *Tr. durum*; 4-rowed and 6-rowed barley; very little oats; a little maize; a great deal of sorghum and millet; and a small amount of *Phalaris canariensis*.

2) *Pulses*. The chief ones cultivated are; the horse bean (very small but stony seeds exported in large quantities to Andalusia), chick-pea, and haricot.

Liquorice grows wild in the fertile valley of Luccas.

3) *Solanaceae*: potato, tobacco, egg plant (this plant, extensively cultivated, produces fruits remarkable for size and sweetness), piment and tomato.

4) *Cucurbitaceae*: calabash (a variety with large round fruits), melon, cucumber, and water-melon (very large fruits, the flesh being mostly bright red in colour).

5) *Vine*. In the Garb the same varieties (white and red muscat) are grown at Malaga for making the famous muscatel raisins; in the region of Ahl-Sérif the vine attains to great size and yields very big bunches of grapes.

6) *Olive tree*. There are found here both the large-sized cultivated olive tree and the wild olive, very abundant, and producing an enormous quantity of small fruit from which a fine oil is made.

7) *Fruit trees*: orange (a variety called "lechin", equal to the Spanish "naranjo chino", yields fruits superior to the Andalusian orange), lemon tree, carob tree (especially in the Wazan territory), pomegranate tree (yields very large sweet fruits and also occurs wild), date palm (attains to great size and exhibits 2 varieties, one with cylindrical and the other with pointed fruits), almond, plum, cherry and quince trees (the latter yields very large fruits); on the other hand, the apple tree, pear tree and peach tree do not thrive. The fig tree, yielding exquisite fruits, is represented by *M. alba* (very abundant), and the Barbary fig (very abundant; its fruit is used to prepare an alcoholic beverage).

8) *Woods*. The cork tree (*Quercus suber*) grows throughout the zone and in two kinds of soils; it forms entire woods which are termed "Gabal" the natives do not utilise either the acorns or the cork, but only the wood which they burn.

Among the species which furnish timber for building or other industrial purposes, special mention must be made of: *Callitris quadrivalvis*, (a fragrant wood), *Fraxinus excelsior*, *Populus alba*, *Ulmus campestris*, *U. australis*, which attains a great size, and different species of *Salix*, *Acacia* &c.

In the thickets and the wooded meadows (which comprise a part of the pasturage) there occur, in more or less close stands: *Pistacia lentiscus*, *Leuropaeus*, *Chamaecrops humilis* (very abundant), *Erica arborea*, numerous acaulescent ferns, etc.

c) *Pasture lands and grass lands.* The principal plants of the pastures and cleared lands ("eriales") consist of different species of *Stenopogon*, *Silene*, *Raphanus*, *Asphodelus*, *Vicia* and comprise also *Orobanchis* spp., French honeysuckle (*Hedysarum coronarium*) growing wild in the district of Arcila and elsewhere, *Antyllus vulgaris*, *Ulex patai* and *Phacelia*, *Arrhenatherum elatius* and the yellow lupin cover wide tracts.

In the numerous *natural grass-lands* which lie along all the streams are predominate: *Lolium italicum*, *Trifolium repens*, *L. pratense*, *L. repens*, *Alopecurus pratensis*, abundant in damp places, etc.

The writer advises that intensive cultivation should be promoted in connection with maize, millet, sorghum, *Phalaris canariensis* (rice in the arid zone of Smid-el-Ma), the cotton plant (*Gossypium hirsutum*) and also grass-lands for stock-breeding purposes.

IV. *Livestock Production.* 1) *Horses.* There are two clearly distinct types: a) the Barbary type; b) the product of a cross between the Barbary and the Arab type. The Arab horse is bred in the interior of the country in the valley of Oued-Draâ near Tafilalet. In the different skeletons of horses examined by the Author the number of cervical vertebrae (7) and that of dorsal vertebrae (8) was constant.

2) *Cattle.* This breed represents a mixture of different or even opposite characters: some of the cattle are brachycephalous, others dolichocephalous; their horns are small, and stature rather low—they are fairly good working animals, but poor meat and milk producers. In the region of Agheira the Dutch cow has been imported from Spain, and crossed with the local breed to improve the production of milk.

3) *Sheep.* There are 2 breeds: a) Merinos, b) Syrian (Asiatic) and their hybrids, both sometimes mingled in the same flock. The sheep of the Merino breed are 31.52 to 33.49 inches in height, their fleece very long, white or yellowish, yields a wool of superior quality, which is exported in large quantities via the port of Larache. The Syrian breed is higher in stature and furnishes a less esteemed wool but its meat is better. The individuals of this breed sometimes have 4 or 6 horns.

4) *Goats.* The goats, which are very numerous, but held in little esteem by the natives, are a variety of the breed inhabiting the southern part of Spain ("cabras costeñas"); they are small in stature, with long shaggy hair, and yield little milk.

Observations on 5 North-American Species of Simulium and their possible Action in disseminating Infectious Diseases. JOHNS-POHREY, ARTHUR W. In United States Department of Agriculture, Bulletin No. 176, 17 pp., 15 figs., 1 plate. Washington, March 6, 1916.

RURAL
HYGIENE.

Certain species of the insects known as "buffalo gnats" (*Simulium*) are considerable pests of man and domestic animals in the United States

as well as in other countries. Although the principal area where they abound in North America is in Canada and the Northern States, the pests of this group occur as far south as Louisiana and Florida. While they are dependent on running water for development (48 hours in stagnant water sufficing to kill the larvae), they make use of very small streams and to some extent of irrigation ditches, and are consequently found occasionally in considerable numbers on the drier parts of the country.

About twenty years ago, buffalo gnats attracted great attention along the lower Mississippi; they frequently became so abundant that plantation operations were stopped on account of very painful attacks against live stock as well as human beings. These great outbreaks were due to conditions produced by the overflow of the Mississippi river. The perfection of the levee system has changed these conditions, so that the outbreaks are less frequent and of greatly reduced severity. The damage done by buffalo gnats results from their painful bite and the loss of blood which ensues. When they are abundant they sometimes cause the death of livestock. At the present time no cases of disease transmission can be attributed definitely to buffalo gnats, but there is the possibility that future investigations may prove them to be transmitting agents of some infectious disease (virulent anthrax, *Psoriasis guttata*, chicken and hog cholera, and pellagra). The study of their biology is of great practical importance, and was carefully carried out by the Author in regard to 5 species: *S. venustum*, *S. vittatum*, *S. bracteatum*, *S. jenningsi* and *S. pictipes*. The following are some of the results:

A female lays the maximum number of 500 eggs. The number of generations per year varies according to species and latitude. In the Southern States of the Union these species seem to supply one generation after another uninterruptedly from March to the middle of November, that is, till the onset of severe cold. The life cycle of one generation during the summer takes about 4 weeks, 7 days in the egg stage, 17 days in the larval stage, and 4 days in the pupal stage. The space of time between egg and adult insect, however, varies according to environment, and above all temperature, being shorter in proportion as the latter is greater. In South Carolina there are probably 5 or 6 generations annually for all the above species except *S. pictipes*, which normally has 3. In Illinois there are only 3 or 4 generations of *S. venustum*.

The larvae of *Simulium* are frequently parasitised by Nematode worms of the genus *Mermis* and also *Myxosporidia*; they are also attacked by species of *Hydropsyche*. The pupae are not known to suffer from these parasites. The adult insect is often attacked by *Mermis*, and several writers have described other enemies of this insect in different countries.

Whether or not the buffalo gnat is a transmitting agent of disease is still a moot question. There is a serious difficulty in the way of solving this problem by experiment, as the adult insect refuses to engorge when in captivity. Therefore all that remains is to dissect the captured insect. "If it could be proved that a *Simulium* which has once engorged blood and oviposited is still in a condition favourable to a second oviposition, that "

rudimentary eggs are present in the ovaries awaiting only a second blood meal for successful development, then there would be a more definite basis for a theory of disease transmission by these insects." The Author used this method, and he discusses the results, which prove the following facts:

1) In all adults taken while ovipositing apparently digested blood was found in the stomach.

2) No eggs within the ovaries developed to the fullest degree without engorgement and the requisite time in which to digest the blood meal.

3) There appears to be strong evidence that after ovipositing (which leaves a few fully developed eggs in the ovaries and the remainder in a rudimentary condition apparently awaiting the necessary factors for development), adults feed again and continue to develop their eggs. The females alone are found engorging on blood, which indicates that they have acquired this habit for a special purpose.

Appended to the study is a bibliography numbering 227 works.

1. **An Experimental Study of Pellagra in Mississippi, United States.** *Scientific American*, Vol. CXIV, No. 1, p. 65. New York, January 22, 1916.

Doctors GOLDBERGER and WHEELER, of the U. S. Public Health Service, have just reported the results of a most interesting experimental investigation of pellagra, carried out at the farm of the Mississippi State Penitentiary. A volunteer squad of 12 white male convicts from 24 to 50 years of age was organized, and these men submitted themselves to experiment under the incentive of an offer of pardon from the Governor, together with assurance of proper care and treatment if needed. There was no history of occurrence of pellagra on the farm, and from the beginning of the experiment the squad was strictly segregated and placed under guard day and night. One man was disqualified in the course of the experiment. The rest remained under observation from the beginning of February to the end of October, 1915. Until April 16th they were kept on the ordinary prison diet and no evidence of pellagra was detected. Thereafter they were kept on a restricted, one-sided, mainly carbohydrate (cereal) diet. Of the 11 volunteers, no less than six developed symptoms, including a "typical" dermatitis, justifying a diagnosis of pellagra. No other person on the farm presented evidence justifying even a suspicion of the disease.

2. **Brewer's Yeast as a Source of Vitamines** *Scientific American*, Vol. CXIV, No. 11, p. 324. New York, March 25, 1916.

A recent report by Mr. ATHERTON SEIDELL, of the Hygienic Laboratory U. S. Public Health Service, describes a successful process of obtaining a cheap and stable vitamine in concentrated form, for use in treating nutritional deficiency diseases, such as beriberi, pellagra, etc. The preparation is obtained from brewers' yeast, which is pressed, autolysed by keeping at a temperature of about 100 deg. F. for 48 hours, and filtered through paper, the filtrate then being treated with LLOYD'S colloidal hydrous aluminium acetate reagent. Finally a solid residue is obtained by siphoning, desiccation, etc. The preparation has been given to pigeons in dose of 0.05 gram alternate days, and the pigeons were thus enabled to retain normal

health and weight on an exclusive diet of polished rice, which would otherwise produce fatal polyneuritis. Completely paralysed pigeons have been promptly cured by this new remedial agent.

RURAL
ECONOMICS

613 The Bureau of Applied Botany attached to the Scientific Committee of the Russian Ministry of Agriculture and its first 20 years of Work (1894-1914).—Rozhnova, N. *Trudy Buro na prikladnoi Botaniku*. (Bulletin of Applied Botany). Year VIII, No. 1-5 (79), pp. 327-638. Petrograd, 1915.

This Bureau, created in 1894, was intended to have three departments: 1) Scientific research; 2) Acclimatisation; 3) Information. It was at first called upon to study the cultivated and wild plants, noxious plants and weeds of the Russian Empire; but from 1907 onwards this programme was cut down. A special Bureau of Mycology and Plant Diseases was created; the study of ornamental plants was placed in the hands of the Imperial Botanical Garden of Peter the Great in Petrograd, and that of forest plants in those of the institutions under the Forestry Department. At the present time the sphere of action of the Bureau extends to the following plants: 1) Cereals (wheat, barley, oats, rye, millet, sorghum, rice, etc.); 2) Industrial plants (textile and oil plants, etc.) and other agricultural plants; 3) Market garden, medicinal and aromatic plants, etc. Finally, the Bureau studies the natural flora, on the one hand noxious plants and weeds and on the other hand meadow plants, especially grasses, sedges and pulses.

The Bureau did not begin operations in a regular way until 1907. The staff now consists of the director, a sub-director and 5 assistants; the work being distributed so that each is in charge of a given department.

The subjects studied include wheat, oats, weeds, comparative morphology of meadow grasses and sedges. As regards cultivated plants the work chiefly relates to obtaining and fixing the different races of plants which are of practical importance to a given region. For these investigations the Bureau secures seeds from all parts of the Empire, either through its correspondents, or from farmers direct, reproducing them and carrying on selection work in the fields of its different sections. The latter, at present number 4, of which 2 own their lands, which were given by the State, namely: the section of Voronej (264.49 acres); and that of Novgorod (449.5 acres); they also have experimental fields in other adjoining provinces and some similar fields in the Caucasus and Turkestan. The location for each section and field is selected so as to present the conditions of the principal typical natural regions of the Russian Empire, namely: forest, steppe and semi-desert.

As regards the organisation of the work of the Bureau of applied Botany an idea of it may be gathered from the method adopted by it for cereals, which is as follows: The entire crop originating from the seed distributed to the sections and to each experimental field of the Bureau is forwarded in the ear, to the Bureau at Petrograd, where it is examined by specialists. In order to study this material, the ears are sorted out according to variety.

(1) The Bureau does not deal with maize in particular, the latter being the subject of a study at the Economic Station of Ekaterinoslav.

and the hereditary differences between the different forms of a given variety are determined. On the basis of the results of these first enquiries the different races are isolated and are studied as follows. On the one hand the isolated races are multiplied in pure lines (originating from an ear or a panicle) and their special biological features ascertained, together with their economic importance in agriculture if possible; on the other hand, on the basis of the material gathered, there is determined the geographical distribution of the different varieties, and afterwards that of the races isolated from the mixed local forms. The determination of geographical distribution and the number of different races in the mixed local forms is of great practical importance, as it clearly establishes the adaptability exhibited by these different races in the course of the struggle for existence under the local conditions of the different regions.

In the course of the investigations of the races of a given species, observations on mixed forms are gradually reduced, and chief attention is directed to the pure lines of the different races. The races fixed by the Bureau not being found on the market generally, the Bureau has organised the production of pure lines of the most interesting cereals, in sufficient bulk to allow of supplying them in small quantities for comparative tests.

At present the Bureau possesses 10 special collections, namely

- 1) Wheats (4 100 samples; 585 pure lines).
- 2) Barleys (2 032 samples; 677 pure lines).
- 3) Oats (1 091 samples; 98 pure lines).
- 4) Ryes (385 samples).
- 5) Millet, Sorghum, Rice, Maize (250 samples).
- 6) Industrial plants (844 samples, including 454 of sunflower).
- 7) Leguminosae (221 samples).
- 8) Meadow plants (490 samples).
- 9) Weeds (seeds of 520 species); subterranean parts of 30 species, 500 samples of weed oats).
- 10) General seed collection (1 000 samples of seeds, chiefly ornamental plants).

Furthermore, the Bureau has since 1908 published a monthly Review entitled: «Труды Бюро по прикладной Ботанике» (Bulletin of Applied Botany) which, since the Plant-breeding Congress held at Petrograd in 1912, has been recognised as the central scientific organ for the work of plant selection in Russia. This periodical contains not only original Russian work, but also summaries of Russian and foreign work on the subjects which are within the scope of the Bureau. The original articles are summarised in French, English or Latin. Furthermore, this periodical often publishes, in an appendix, translations of the most important works published abroad, which may afterwards be collected into separate volumes. Finally the Bureau also publishes propaganda pamphlets on the subjects within its competency.

CROPS AND CULTIVATION.

- 014 - **The Presence of a Wet-repelling Film on the Surface of Particles of Sand and Mould.** — DEVAUX, H., in *Comptes Rendus de l'Académie des Sciences*, Vol. 162, N pp. 197-199, Paris, January 31, 1916

On scattering a little dry sand on any water surface it is observed that most of the grains float. The usual proportion found by the Author with a sand of 0.37 mm. to 0.63 mm. diameter of grain was 60 to 65 %. A curious fact is that when the sand is very slightly moist (0.5 %), it still floats, better even than when dry in many cases, the proportion going up to 90 %. As soon, however, as the percentage of water reaches 1 % all the grains immediately sink, not a single one floating. Therefore important changes must take place in the relations of the water to the sand, according as the latter is dry or moist to any degree.

Direct examination of the floating grains shows them to be incompletely wetted; a small area of surface remains dry, even after the lapse of several days.

It was found that :

1) After calcining, all the grains sink at once, retaining this sinking quality for several days.

2) When grains of sand are dropped on to a thoroughly clean water surface over which a thin film of an inert powder (talc) has been spread each grain of sand in falling displaces the talc grains violently, which is a sure sign that a foreign substance with low surface tension is yielded up by the sand at the surface of the water. This substance is still given off by sand with 0.5 % of water and also sand with 1 % or more. In the latter case the quantity of substance given off is greater than with dry or nearly dry sand. The latter result is of particular interest because, in the case of moist sand, all the grains thrown on the water sink at once. This sinking is accompanied by a divesting process; the moist sand may be regarded as surrounded by two concentric layers, one of water lying immediately against it, and the other of low tension impurities. This latter is an organic coating destroyed by calcination and displaced mechanically by the water in the second case.

These facts are not confined to pure sand; they are also exhibited by soil to a much more pronounced degree even, in the finer portions. They are at their maximum in humus, and at their minimum in clay. The almost universal presence of a wet-resistant coating on the particles of the majority of soils is therefore a demonstrated fact. Necessarily, it reacts on the capillary properties of the soil.

- 015 - **The Movement of Soluble Salts with the Soil Moisture, Experiments at Utah, United States.** — HARRIS F. S., in *Utah Agricultural College Experiment Station, Bulletin* No. 139, pp. 119-124, 3 tables, 2 diagrams. Logan, Utah, 1915

In the irrigated districts of the arid regions in the United States, where excessive quantities of water are used, there is usually an accumulation of

alkaline salts in the soils of the lower lands, in such quantities as to prohibit the growth of crops.

With the object of reclaiming these soils by drainage, it is important first of all to determine the rate of movement of injurious salts with water through the soil. To clear up this question the Author carried out a number of experiments to ascertain the movement of salts: 1) horizontally; 2) upward; 3) downward.

1) *Horizontal movement of salts.* Special tanks were arranged, made of galvanised iron, 6 feet long, 1 foot wide and 4 inches deep. Soil (or other substance) was placed in the tanks to a depth of 3 inches, and, during the six months' period of experiment, 10 litres of tap water entering at one end were passed through the soil in each tank. The first 5 square feet of this soil were covered with paraffined paper to prevent evaporation, one square foot being left open at the end opposite to the water inlet for free evaporation of the water. The different substances used in the experiment were:

- | | |
|------------------------------|-----------|
| 1) Greenville loam | 5. Clay |
| 2) Greenville loam + 1% NaCl | 6) Muck |
| 3) Greenville loam + 2% NaCl | 7) Manure |
| 4) Sand | |

At the end of the experiment the soil etc. was removed from the tanks in foot sections and the samples numbered 1 to 6, starting from the water inlet. The quantity of soluble salts remaining in each section was then determined. By averaging the quantity in each section of the different substances, the figures of Table I were obtained.

TABLE I. — *Average quantity of soluble salts remaining in each section of soil through which 10 litres of water had passed horizontally in 6 months (in parts per million of the dry substance).*

Section No. 1	Section No. 2	Section No. 3	Section No. 4	Section No. 5	Section No. 6
1.986	1.782	2.773	3.574	7.119	39.840

2) *Upward movement of salts.* Evaporating cans of the STEVENSON and SCHAUB model were used, 11 inches in diameter and 13 inches deep, with a water supply tube at the bottom. Into 9 of these cans 10 kilograms of Greenville loam were placed, containing: 0, 1, 2, 3, 4, 5, 6 and 7% respectively of sodium chloride. The soil was all made up to the same moisture percentage, and water added through the tube in the bottom twice a week to keep the weight constant. After 37 days the soil was removed in 6 sections of 1 inch each, and the total of soluble salts remaining in each sample determined. By taking the average of the respective quantities found in each section of the 9 cans, the figures of Table II were obtained.

TABLE II. — *Average of soluble salts in various depths after water evaporated from soil for 37 days (in parts per million of the dry soil)*

Depth of each Section	Quantity of salt removed
0-1 inch (0—2.54 cm.)	120.35
1-2 inches (2.54—5.08 cm.)	37.581
2-3 inches (5.08—7.62 cm.)	20.64
3-4 inches (7.62—10.16 cm.)	11.91
4-5 inches (10.16—12.7 cm.)	10.60
5-6 inches (12.7—15.24 cm.)	9.552

In all the cans there was a decided upward movement of salts and accumulation at the surface, to the point of crystallisation. This was especially pronounced in the soils containing a large amount of salt. This experiment shows that the salts readily move upward with the water current and illustrates the method of alkali accumulation on the surface of irrigated lands.

3) *Leaching of Soils.* 5 glass percolators of the Oldberg type were filled with Greenville loam and arranged on a rack one above another so that water dripping from the top one percolated into the one below, and so on to the bottom. Above the top percolator was an inverted water bottle kept filled with water. A bottle was placed below the bottom percolator to catch all the water that passed through it. When one bottle was filled with the drainage water another was put in its place.

For 3 months water was constantly passed through the arrangement of percolators, fifty litres in all. The drainage water was caught up in 10 bottles, each holding about 3 litres, and the soluble salts determined in each bottle separately.

The first leaching contained 651 parts per million of solids. After this the salts dropped down to about 200 parts per million, and remained fairly constant during the rest of the experiment, falling finally to 172 per million in the 16th leaching.

The soil was allowed to remain in the percolators 6 months after the leaching had been discontinued. The nitrates and soluble salts were then determined in the soil of each percolator. The numbers found were comparatively uniform, ranging between 512 and 599 parts per million for the soluble salts, and 106 and 125 per million for the nitrates.

These various experiments, as a whole, show that salts are transferred through the soil very readily by moving water.

The Alkaline Reaction Produced by Acids in Soils, Viewed from the Standpoint of Plant Nutrition (11). MASONI GULLO, Laboratory of Agricultural Chemistry of the Royal University of Pisa, in *Le Scienze sperimentali e appl. italiane*, Vol. XLIX, Part 2, pp. 132-140, Modena, 1916.

In previous work (*Le Scienze sperimentali e appl. italiane*, Vol. XLVI, 1913, p. 241 and Vol. XLVII, 1914, p. 974), comprising experiments with several acids and inorganic salts on chalky soils, it was found that citric acid in a comparatively high proportion and tartaric and malic acid in relatively smaller proportions (and also their acid salts) are alone, in spite of the alkaline reaction they cause, capable of retaining iron in solution, which is not the case when other, though possibly stronger acids are used; this phenomenon is related to the well-known property of oxyacids of combining metal in special complex ions. A relation is thought to exist between the above phenomena and the chlorosis of limestone. Chlorosis in limestone soils, or, in a wider sense, the absorption of iron by plants in these soils, is thought to be connected with the nature of root secretions, absorption being impeded for those plants in particular the root secretions of which contain too little or none of the acid substances which, though they bring about the formation of OH in excess, allow iron to be present in solution, as in the case with citric, malic and tartaric acids and their salts.

This hypothesis is confirmed, inter alia, by the experiments of MAZE, ROUX and LEMOIGNE, in which the addition of very small quantities of tartaric acid and Rochelle salt, or citric acid and sodium citrate, proved particularly effective in causing the return of a green colour in chlorotic plants grown in nutritive solutions containing iron and mixed with carbonate of lime.

Similar experiments were then made with compounds of manganese (viz: 1) common soils; 2) mixtures of pure calcium carbonate with different compounds of manganese (manganous oxide, manganous-manganic oxide, manganese dioxide, manganese carbonate, manganese sulphate); 3) a mixture of common soils with manganese sulphate or dioxide. The action of the following acids, used almost always in decinormal solution, was tested: *general*: hydrochloric, nitric, sulphuric, and phosphoric; *organic*: formic, acetic, oxalic, succinic, malic, tartaric and citric. From 25 to 50 grams of earth or mixture were treated with 50 to 100 cc of the acid solution; the whole was shaken up several times, and some time later (mostly 8 hours, but always after the liquids had shown the alkaline reaction), it was filtered and the filtered liquid examined for manganese.

1) The experiments with soil prove that among the different acids used, oxyacids alone retain manganese in solution in large proportions. Notwithstanding the occurrence of the alkaline reaction due to them, citric acid and malic acid proved particularly active; tartaric acid on the other hand showed very favourable activity, which may possibly be connected with the greater insolubility generally presented by metallic tartrates in the presence of the corresponding citrates.

2) The trials made with pure calcium carbonate and with oxides of

1) See also B. July 1913, No. 1, 5.

manganese demonstrated the decisive influence of the lime in the phenomena studied. The oxide of manganese behaved rather differently from the other oxides, giving a comparatively strong manganese reaction in the filtered liquid, even with acids other than oxyacids.

With manganese carbonate, much smaller quantities of manganese were obtained in solution, even under the action of oxyacids. These facts are explained by the remarkable facility of hydrolysis presented by manganese compounds, in solutions either dilute or of medium concentration.

The tests with manganese sulphate and calcium carbonate were conducted with quantities of salt corresponding to 2, 5 and 50 milligrams of manganese (in aqueous solution) to 15 grams of calcium carbonate; the solution of manganese sulphate and of calcium carbonate were left in contact for 12 hours before adding the acids; the filtered liquid was tested after 6 hours, and also after 24, 36 and 48 hours in the tests with 2 and 50 mgms. of manganese. With the smallest quantity of manganese, whatever the acid used, relatively large quantities of manganese passed into solution 8 hours from the beginning of acid action, but these quantities were larger with citric and malic acid. On the filter a compound of manganese insoluble in water remained. 24 hours after the start of acid action no manganese remained in solution except in the test samples with citric and malic acid, not with the other acids. In the tests with 5 and 50 mgms. of manganese, a strong manganese reaction was found in the liquids, even after 36 and 48 hours, the explanation of which would be that some quantity of manganese sulphate remained in solution unchanged. Perhaps in this case likewise phenomena of hydrolysis became active during the prolonged contact between calcium carbonate and manganese sulphate, leading to the formation of manganese carbonate or oxides of manganese of different compositions, on which the acids successively produced the special action observed.

3) Experiments with manganese sulphate and dioxide mixed with earth proved: *a*) that for small quantities of sulphate (2 mgms. of manganese to 50 mgms. of earth), the treatment with citric and malic acids alone increased the quantity of manganese passing into solution, while for relatively large quantities (50 mgms. of manganese to 50 gms. of earth), the increase in dissolved manganese was marked on treatment with any acid; *b*) that, for dioxide, there was no increase of the manganese dissolved except on treatment with citric and malic acids.

The difference between these results and those of the preceding series may be explained by the far greater facility with which phenomena of hydrolysis take place in a soil, and the special action of the mass of soil on the adsorption of small quantities of products in solution.

It follows that the compounds of manganese naturally contained in the soil behave in a similar way to iron compounds as regards their solubility in acids, when lime is in excess, and the markedly greater capacity of oxyacids for retaining these elements in solution, in spite of the excess of OH occasioned by the acids themselves, is therefore likewise confirmed with regard to the manganese in the soil.

These experimental investigations were made at the Institute of Hygiene of the University of Turin during the 5 past years, under various conditions of environment. They prove the following:

Action of Nitrogenous Compounds. The presence of these in a high proportion prevents fermentation of impure cultures and the formation of the typical film. In liquids containing 5% of asparagine in a purified culture no films formed. Low percentage of nitrogen restores vegetative activity of *Azotobacter* on a solid medium (for instance nitrogen free agar).

Action of Compounds of Magnesium (dose 1 "cm). In the presence of sulphate of magnesium, and magnesium and sodium phosphate, fermentation begins sooner than in the presence of magnesium oxide. Magnesium chloride, showed no marked positive action.

Azotobacter in Different Soils. All soils do not possess the same fermentative power and the same capacity for producing the film, as is shown by the following table.

	Fermentation
Rice-field ditch soil	Weak
Permanent rice-field soil	Good
Rice-field soil under upper part	Good
" " deeper part	Very weak
Irrigated meadow soil	Good
Compost	Very active
Filled stubble soil	Very active
Nursery soil	Active
Chalky vine soil { cultivation layer	Very weak
sub-soil	Nd

Growth in Association. On agar, *Azotobacter* multiplies better in the presence of *Sreptothrix* (chiefly *S. alba* and *S. odorifera*) than alone. A better growth is also obtained by combining the typical *Azotobacter* with the

blastomycetic form; in the presence of the latter the spread of the mycelium patch formed by the colonies is more complete and more rapid.

The best tilled soils, well ventilated, provided with humus and manure, and with mineral fertilisers, are those in which the growth of *Azotobacter* is most active, and the fixation of nitrogen in them is considerable. The best conditions of this micro-organism therefore are a fresh proof of the efficiency of rational methods of practical agriculture.

018 - **Sterilisation of the Soil by Dry Heat.** — See No. 677 of this Bulletin.

019 - **Texture of the Soil in Java, Determined by Mohr's Method of Mechanical Analysis.** — VAN HARREVELD-LAKO C. H., in *Mededeelingen van het Proefstation voor de Suikerindustrie, Archief voor de Suikerindustrie in Nederlandsch Indië*, Year XXIV (1916), Soerabaja, January 1916.

A description is here given of MOHR's method of mechanical analysis, which differs from ATTERBERG'S method in that it sorts out the particles more gradually, and is more suitable for earths of volcanic origin.

MOHR separates the particles of the soil by centrifugalising a specimen, to which water and a few drops of ammonia have been added. A jet of water under high pressure is made to play on the residue to disintegrate the particles, which are then again subjected to centrifugal action. By treating the successive residues in this way, particles of the following dimensions are separated from it:

from 2	to 1	mm	from 0.05	to 0.02	mm
" 1	to 0.5	"	" 0.02	to 0.005	"
" 0.5	to 0.25	"	" 0.005	to 0.002	"
" 0.25	to 0.1	"	" 0.002	to 0.0005	"
" 0.1	to 0.05	"	less than	0.0005	"

The analysis of a few Javanese soils on this method proved the following:

Soils in which particles of 0.5 to 0.05 mm predominate allow rain and irrigation water to filter through rapidly and require plentiful irrigation for sugar-cane growing. They also need dressing repeatedly with sulphate of ammonia in small quantities.

The texture of the soils in which particles ranging from 0.05 to 0.02 mm predominate is very favourable to sugar cane cultivation. They are sufficiently absorptive and at the same time readily allow the excess of moisture to flow off.

The soils containing chiefly particles ranging from 0.02 to 0.002 mm are less favourable in texture for sugar-cane growing.

020 - **Injurious Effect of Farmyard Manure on the Balance of Nitrogen in the Soil.** — SABACHNIKOV A., in *Ветерское хозяйство и животноводство* (Agriculture and stock culture), Year LXXVI, Vol. CCL, pp. 5-19. Petrograd, January 1916.

A retrospective study of this important problem, based on the results of laboratory and field experiments conducted by different Russian and foreign investigators during the last 25 years led to the following conclusions:

1) The chief influence of farmyard manure on the balance of nitrogen in the soils must be attributed to the organic matters it contains and not to the micro-organisms, which are of secondary importance.

2) The organic matter in the manure, especially undecomposed raw being a good source of carbon for the soil micro-organisms, contributes: a) in an aerobic environment to the assimilation of nitrates, ammonia, amides and gaseous nitrogen and their deposition in proteid form; in an anaerobic environment, in the presence of nitrate, to the assimilation of the latter; and also on the other hand to its denitrification.

3) The nitrogen in farmyard manure is chiefly in an organic form, and its loss in the gaseous state is possible without its passing into the nitrified state, both in an aerobic and anaerobic environment.

4) The organic matter, contributing to the conversion of the proteid nitrogen, indirectly promotes the loss of nitrogen in further decomposition.

5) A local retardation (in furrows, etc.) of the nitrifying processes is also possible owing to the organic matter, to the presence of which the nitrifying organisms are known to be very sensitive.

6) As to the question whether farmyard manure supplied to the soil in ordinary quantities (up to 28 tons per acre) reduces nitrification or not, the reply is that a negative conclusion cannot be drawn.

7) To the question whether farmyard manure has any influence on the loss of nitrogen in the soil, the answer may be partly yes and partly no, the nitrogenous condition of soil not dressed with farmyard manure being unknown. Possibly the presence of vegetable residues in the soil and the continuous conversion of nitrogen from the soluble form into the organic form or vice-versa may cause such heavy losses of nitrogen (although compensated by its assimilation from the air) that the effect of the additional organic matter in the form of farmyard manure is relatively unimportant. Furthermore, farmyard manure, from this point of view, is a substance which occasions both a gain and a loss of nitrogen.

21. On the Capacity of White Mustard to Fix Nitrogen and Enrich the Soil.

PERIFFER, in *Föhdlin's Landwirtsch. Jahrb.*, Year 60, No. 11, pp. 373-374, Stuttgart, November 1888, 1888.

Some years ago, Professor Hiltner stated that white mustard can enrich the soil in nitrogen. With a view to verifying this statement an experimental answer was sought to the following questions:

1) If a cereal and white mustard are sown together and the mustard is killed before flowering time (with sulphate of iron), is the cereal able to benefit by the fertilising elements fixed by the mustard, so as to furnish a larger yield than the cereal sown alone?

2) What are the nitrifying powers of the soil in the cases when a cereal and mustard together, and a cereal alone, are grown respectively?

The experiments were made in 12 pots, 30 cms. high, 16 to 17 cms. in diameter and 0.1 sq. metre in clear section, each containing a mixture of clayey-silicious earth and sand, to which a basal manure, consisting of 13 gms of monocalcic phosphate, 4 gms of sulphate of magnesium, 16.6 gms of sulphate of potash and 10 gms of calcium carbonate, was added.

After the first period of growth, nitrogen was given to the plants in the form of sulphate of ammonia, namely: 0.1 grm per pot on the 2nd April, and 0.5 on the 11th May.

In 9 pots oats and white mustard were sown together; in 3 pots oats only. When the mustard began to flower it was killed in 6 pots by means of sulphate of iron. In 3 pots of this set the mustard was left for the treatment with sulphate of iron, to serve as green manure; in the other 3 pots it was removed. Again, in 3 pots the mustard was not killed and was allowed to grow until the oats were completely ripe.

Results of the Experiment. -- The white mustard left on the earth, in the pots not only did not increase the oat crop, but even reduced it to a small extent.

The analysis of the oat plants showed that they had not benefited by the nitrogen of the green manure formed by the mustard which had been allowed to remain.

The pots containing oats only, gave a yield much higher than that of the pots containing oats and mustard together. The explanation is that the mustard utilised a portion of the nitrogen of the soil for its growth, at the expense of the oats.

With regard to nitrification, it was feeble in the pots containing oats and mustard than in those with oats alone, but the difference was very small, being 0.33 ± 0.103 mgms.

The experiment thus shows that, contrary to Hiltner's assertion, white mustard is not a source of nitrogen for the soil and plants cultivated there.

632 - *Investigations into the Utilisation of Phosphorites in Russia.* - I. PRIYANIKOV, D. N. *On Experiments with Phosphorites in 1914, in: Опыты над влиянием на химическую переработку фосфоритов и вегетационных опытов, под редакцией проф. Д. Н. Прянишникова* (Experimental Studies on Phosphorites), Vol. V, pp. III-IX, Moscow, 1915. - II. KASAKOV, A. V. The Extraction of Phosphoric Acid from Natural Phosphates, (influence exerted by the form of the acid and the speed of rotation on the course of reaction), *Ibid.*, pp. 1-15. - III. KONTEKOV, N. The Preparation of Superphosphates by means of Santov and Perm Phosphorites, *Ibid.*, pp. 16-22. - IV. KOTCHETKOV, V. N., and KOBLKOV, N. P. The Extraction of Phosphoric Acid from the Phosphorites of Witka, *Ibid.*, pp. 12-15. - V. CHEZOV, K. N., *Study of the Process of Precipitation*, *Ibid.*, pp. 23-37. - VI. KASAKOV, A. V., The Action of Mineral Acids in small quantities on natural Phosphates of Lime, *Ibid.*, pp. 38-50. - VII. JAKUCHKIN, I. V., Phosphates in the Soils of the Experimental Stations of Southern Russia, *Ibid.*, pp. 51-65. - VIII. JAKUCHKIN, I. V., On the Assimilation of the Phosphoric Acid in some Phosphorites by Cereals, *Ibid.*, pp. 66-81. - IX. L'ESPENSKIY N. A., *Wolff's Plate*, *Ibid.*, pp. 85-100.

Vol. V of the works of the Agronomic Institute of Moscow for investigations of phosphorites contains the reports drawn up by Prof. PRIYANIKOV on the investigations in 1914 relating to: 1) chemical preparation of phosphorites; 2) field tests on crops with these phosphorites. The experiments bore partly on the possibility of increasing the number of phosphorites susceptible of direct conversion into superphosphates, and partly on the improvement of the methods of extraction of phosphoric acid for the preparation of concentrated phosphate manures; with this view the conditions

precipitation of phosphoric acid from the solution were also studied, the crop tests the action of bicalcic phosphate and some phosphorites studied.

The following is a brief summary of the results of the most important these experiments presenting any general interest:

A — EXTRACTION OF PHOSPHORIC ACID FROM PHOSPHORITES. — In the experiments made during the preceding years by M. KASAKOV in the laboratory of Prof. PRIANICHNIKOV it was found that by steeping the phosphorites in a given quantity of water and afterwards treating the mixture with sulphuric acid, almost the whole of the phosphoric acid contained therein may be extracted, a result unobtainable by other methods. The experiments of KASAKOV and Messrs. KORCHENKOV and KOBILIKOV, carried out in 1914, complete the study of the subject.

1. KASAKOV's experiments were directed to determining the influence exerted by the shape and speed of rotation of the agitator on the reaction taking place in the mass of phosphorite powder and sulphuric acid. Trials were made with different types of agitators, that of GATIKMAN giving the best results.

In the experiments with phosphoric powder of Viatka, the degree of concentration of the sulphuric acid was varied (from 10 to 50 %), and also the speed of rotation of the agitator (300 to 1800 revolutions per minute). The results of these experiments may be summarised as follows:

1) The quantity of froth (undesirable for many reasons) formed in the decomposition of the phosphorites owing to the evolution of gas (especially CO_2) diminishes as the speed of rotation of the agitator is increased.

2) At a given speed of rotation froth ceases to form, and the reaction then reaches its maximum energy. This speed, which may be called the optimum, depends on the dimensions of the agitator and the vessel, the quantity and quality of the mass, degree of concentration, etc., but varies within very narrow limits, which remain constant, all other conditions being equal. By observing the surface of the mass and correspondingly altering the speed of rotation of the agitator, the optimum speed may be secured in the most divergent conditions. Some practical methods for effecting this determination are also suggested.

3) With an insufficient speed of rotation of the agitator, the separation of phosphoric acid is incomplete; it is also incomplete if sulphuric acid of 40 per cent strength and beyond is used. Thus, by using sulphuric acid of 10.19 per cent., 99 per cent. of the total phosphoric acid was separated, while by employing sulphuric acid of 40 per cent., and afterwards 60 per cent strength, the yield of phosphoric acid dropped to 62.55 and 64 per cent, respectively of the total quantity.

4) In laboratory investigations of phosphorites it is essential to definitely the method employed for mixing the mass, as this has a marked influence on the behaviour of the reaction. On the other hand the results of the enquiries of KASAKOV furnish practical indications even for the industrial extraction of phosphoric acid from phosphorites.

II. In their experiments on the extraction of phosphoric acid from the

phosphorites of Viatka, Messrs. KORCHETKOV and KOBLIKOV studied the influence exerted on the process of extraction by : the quantity and concentration of the sulphuric acid, the steeping of the phosphorites in water, the temperature, the duration of the treatment and of mixing. They obtained at the following results :

Alterations of the conditions under which the phosphoric acid is extracted have a marked influence on the proportion extracted, it being possible, by suitable modifications, to bring up the amount of phosphoric acid passing into solution from 73.77 to 95.67 per cent. This result, which is the maximum, was secured by continually stirring up the mass during the entire period of reaction (10 minutes), after previously steeping the phosphorites in water and subsequently treating them with sulphuric acid at 70°C . (156°F).

On the basis of these experimental results and those of previous years it is stated that the problem of the complete extraction of phosphoric acid from any phosphorites by means of sulphuric acid is now effectively solved.

III. It being possible to manufacture precipitated phosphates instead of superphosphates in Russia, M. CHVEZOV has investigated precipitation by means of gypsum in different solutions of phosphoric acid, endeavouring to determine the influence of different factors. It was found that : 1) the quantity of gypsum directly influences the process of precipitation ; 2) with increase of the quantity the speed of reaction grows, but at the same time that the percentage of phosphoric acid and soluble phosphoric acid in the citrate of ammonia declines, as well as the quantity of undecomposed gypsum ; 3) the fineness of the base markedly affects the process. Among the results of these experiments mention must be made of that relating to temperature of the solution : an increase of temperature of the solution of precipitation decreases the solubility of the precipitate in citrate of ammonia and probably the degree of assimilation ; enquiries into this question are of interest, as they will bring to light the conditions for attaining the most assimilable precipitates.

IV. By enquiries into the action of the mineral acids in small quantities on natural phosphates, M. KASAKOV desired to ascertain what method for obtaining bicalcic phosphate, a simpler method can be used instead of precipitation by lime water or gypsum, requiring a lesser quantity of acids than in the production of superphosphates and avoiding the use of lime.

The results as regards natural phosphates of lime (bones and phosphorites) are as follows :

On treating bones freed from grease and degelatinised (34% P_2O_5) it is found that aqueous solutions, dilute or concentrated, of phosphoric acid, and also of pure or commercial sulphuric acid, used in sufficient quantities, completely convert the phosphate of the bones into crystalline bicalcic phosphate ($\text{CaHPO}_4 + 2\text{H}_2\text{O}$). Treatment with phosphoric acid yields a product containing 38 to 39 % of that acid soluble in citrate part in PETERMANN'S reagent (up to 91 %). When the phosphates are treated with sulphuric acid (in small quantities), the result is the " semi-soluble"

phosphate" (a name denoting the technical product containing both bicalcic phosphate and gypsum) which has excellent physical properties and rains on the average 23 per cent. of total phosphoric acid, most of it (to 90 %) soluble in PETERMANN'S reagent.

Nevertheless, negative results were obtained when the phosphates were added with commercial phosphoric acid (a concentrated extract obtained in phosphorites by the aid of sulphuric acid); this failure is attributed to the "inactivity" of the phosphoric acid, the reason and the conditions of presence of which will be studied subsequently.

B. CULTIVATION TRIALS WITH PHOSPHATES AND PHOSPHORITES.
The cultivation trials with phosphates, carried out by JAKUCHIKIN, had for their object the comparison of the action of precipitated phosphate and erpophosphate, the latter being regarded in southern Russia as the most effect phosphate manure and impossible to surpass for black earths.

The soil for the cultivation tests was taken exclusively from the fields of the experimental stations in southern Russia; the plants were millet and ar-beet, and the manures used were: 1) superphosphate with 15% P_2O_5 , prepared according to standard methods; 2) "to", basic slag of Russian production; 3) Palmer's phosphate, considered to be the best precipitated phosphate (37.04% P_2O_5); 4) precipitated phosphate from a Russian factory (40% P_2O_5), the only bicalcic phosphate produced in Russia on an industrial scale. The results of the experiments, as regards comparison between the action of superphosphates and bicalcic phosphates on black earths, proved that the latter, if properly prepared, are equal in their action to superphosphates and sometimes even superior, as shown by the following table, which indicates the results given by Palmer's phosphate, taking the crop obtained by using superphosphate as equal to 100.

Station of	Millet	Ar-beet
Simbirsk	100	100
Tchirn-chinsk	100	100
Ekaterinoslav	100	100
Rostov	100	100
Mironovka	100	100
Svatovka	100	100
Konstantinograd	100	100

II. The cultivation tests with phosphorites, also carried out by JAKUCHIKIN, are a continuation of the trials in which he had shown that there are phosphorites containing phosphoric acid in a form which can be assimilated by cereals. Taking as a basis the fact observed in previous years—that 4 to 5 % of the total phosphoric acid in the phosphorites is soluble in PETERMANN'S reagent (alkaline citrate of ammonia)—the cereals are able to utilise appreciable quantities of the phosphoric acid, the winter wheat, among the many specimens which the Commission for the study of phosphates sends to the laboratory, to select those best adapted for his investigations, and he found that some phosphates of the province of Saratov are partly assimilable by cereals.

623. **Chemical Composition of "Potassic Ash".** — WÜRTHEIM A. (Rijksoverheid-proefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen landbouw-proefstation*, No. XVIII, pp. 86-89, La Haye, 1915.

In the smelting of iron in blast furnaces, the gases which are given off deposit their solid particles in the form of a brown powder. This powder is utilised as manure under the name of "potassic ash", and its value depends on its contents of soluble potash. About 80 per cent of the total potash is soluble in water; the proportion of potash and of the other components, however, vary to such a degree that no average can be fixed. The analyses of samples gave the readings shown below:

Composition of 3 Samples of Potassic Ash.

Components	Specimen No 1	Specimen No 2	Specimen No 3
Potash	9.96 %	10.38 %	10.78 %
Soda	5.54	5.82	6.63
Iron	3.73	26.86	4.70
Alumina	0.26	2.01	0.49
Manganese	8.21	2.98	2.71
Magnesia	5.39	3.11	1.07
Lime	16.87	7.60	12.14
Silicates (SiO ₂)	39.74	15.41	20.80
Chlorides (Cl)	0.89	1.24	12.66
Sulphates (SO ₄)	0.12	2.70	1.13
Sulphides (S)	1.49	0.61	1.23
Carbonates (CO ₃)	4.91	2.86	1.53
Cyanides (CN)	0.21	0.10	0.21
Sulphocyanides (CNS ₂)	0.30	0.12	0.83
Phosphates (PO ₄)	—	0.24	0.23
Moisture	1.52	1.74	1.18
Loss in calcination	3.12	4.30	2.53

It should be noted that the high chlorine content of specimen No. 3 may be a difficulty as regards its use for manuring purposes, particularly with chlorophobe plants.

624. **Edible Mushrooms of Hungary.** — BERNÁTSKY JENŐ, in *Erteszött Kísérleti Növénytan*, No. 3, pp. 81-113, 6 photographs, Szeged, 1913.

Observations made in the course of the last 20 years have led the writer to conclude that edible mushrooms are abundant in Hungary, but the consumption is rather limited; firstly, because the consumers are excessively prudent or the sellers insufficiently informed; and secondly, owing to the

ity, mistaken or contradictory particulars given in the literature of the subject with regard to certain edible mushrooms. With a view to dealing with these points, the writer decided to, 1) collect physiological and chemical information in reference to the edible mushrooms of any economic importance of the different parts of the country; 2) to make a statement on certain general considerations with regard to different species, edible, poisonous, or indifferent; 3) to give clues for determining the species easily resembling each other; 4) furnish practical advice on the gathering and utilisation of mushrooms. The article is followed by an alphabetical list of the scientific names and the common Hungarian names.

The following is the list of edible mushrooms:

<i>Agaricus piperatus</i> Fr.	<i>Cantharellus cibarius</i> Scop.
<i>Arctostaphylos</i> Fr. (= <i>L. cantharus</i> B.)	<i>Boletus ramulosus</i> L.
<i>Boletus rubescens</i> Pers. (= <i>Agaricus rubinus</i> Scop., or <i>A. pustulatus</i> Schaen.)	<i>Boletus Schaen.</i> (= <i>Boletus stipitatus</i> L.)
<i>A. procera</i> Scop.	<i>B. apothecarius</i> Bull.
<i>Cantharellus cibarius</i> A. C. S.	<i>B. scaber</i> Bull.
<i>Cantharellus</i> Fr.	<i>B. stipitatus</i> L.
<i>Cantharellus cibarius</i> Schaen.	<i>B. stipitatus</i> Kromb.
<i>Cantharellus</i> Fr.	<i>B. stipitatus</i> L.
<i>Cantharellus</i> Fr.	<i>B. stipitatus</i> Willd.
<i>Cantharellus</i> Fr.	<i>Cephus cibarius</i> Mull.
<i>Cantharellus</i> Schaen.	<i>C. stipitatus</i> Bull.
<i>Cantharellus</i> Fr.	<i>Cantharellus cibarius</i> L.
<i>Cantharellus</i> L.	<i>Cantharellus</i> H. Dan.
<i>Cantharellus</i> Fr.	<i>Cantharellus</i> Pers.
<i>Cantharellus</i> Fr.	<i>Cantharellus cibarius</i> Pers.
<i>Cantharellus</i> Pers.	<i>Cantharellus</i> H.
<i>Cantharellus</i> Pers.	<i>Cantharellus</i> Schaen.

5. **Manganese in Wheat.** HAYDEN W. P. (Chemist, Colorado Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. V, No. 8, pp. 779-787. Washington, D. C., 1915.

The presence of manganese has already been detected in different plant parts, and is even supposed to exist in all. Some writers maintain it to be an occasional constituent; others say that it plays an important physiological part as a catalytic agent. The writer ascertained the quantity of manganese in a series of specimens of wheat and other cereals, with the results given in the following Table.

Conclusions.—(1) Manganese seems to be present in wheat whatever its origin, independently of soil and climatic conditions.

(2) It is present in the wheat grain in the same proportion as iron, although the latter greatly predominates in the soil.

(3) Manuring does not increase the quantity of manganese in the grain.

(4) The amounts of water supplied to the cultivations (from 1 to 3 feet) did not affect the manganese content of the grain.

(5) Manganese being present in all the grains (and plants) investigated, in more or less equal quantities and under different conditions, it seems unlikely that it can be other than an essential constituent.

Appended to the original is a list of 7 works consulted.

*Manganese Contents of different Wheats and other Cereals
(as percentage of air-dried material)*

Cereals analysed	Manur: or treatment	Origin	Mn., %
<i>Wheat (grain):</i>			
Varieties «Defiance», «Red Fife» and «Kulanka»	Nitrogenous manure	Colorado (U. States)	0.004 - 0.005
„ „ „ „ „ „	Phosphatic manure	„ „	0.004
„ „ „ „ „ „	Potassic manure	„ „	0.004 - 0.005
„ „ „ „ „ „	None	„ „	0.004 - 0.005
„ „ „ „ „ „	1 year fallow	„ „	0.005
«Marquis» variety,	Stable manure	Idaho (U. States)	0.005 - 0.006
„ „ „ „ „ „	None	„ „	0.005 - 0.006
Different varieties	—	U. States - Canada - Russia - Sweden - Holland.	0.004 - 0.005
Two grain wheat (<i>Triticum dicoccum</i>)	—	Colorado (U. States)	0.004
<i>Other cereals (grain):</i>			
Rye	—	Colorado (U. States)	0.004
Naked barley	—	„ „	0.004
Oats	—	„ „	0.004
<i>Wheat (whole plants):</i>			
Varieties «Defiance», «Red Fife» and «Kulanka»	Phosphatic manure	Colorado (U. States)	0.002 - 0.003
„ „ „ „ „ „	Potassic manure	„ „	0.002 - 0.003

(126) - **Investigations into Vegetable Oils: Results and Problems.** — IVANOV S.
in *Урожайное хозяйство и Землеведение* (Agriculture and Sylviculture), Year LXXX,
Vol. CCXLIX, pp. 399-418. Petrograd, November 1913.

This paper embodies the results of researches into vegetable oils extending over a period of 7 years. Among the chief objects of the writer was that of demonstrating that the nature of these oils must vary according to the different classes of the vegetable kingdom. By studying the processes of their formation in different plants and ascertaining the features common to these processes it might be possible to discover principles enabling a "natural classification" of vegetable oils to be substituted for the present, artificial, one.

Systematic enquiries into botanic families have shown that kindred forms exhibit a resemblance in the process of formation of the oils, and identity in the reserve products. There are entire groups of plants which furnish perfectly similar oils and other products. On the other hand different families produce oils containing different fatty acids.

The process of formation of the oils during ripening of the seed exhibits its common feature that the value of the iodine index enables the course of this process to be predicted. Oils with low iodine index are formed with all their characteristics in the seeds, at the very start of the process while those with high iodine index form gradually, and the oils correspond

to the first ripening stages of the seeds differ greatly from those of the more advanced stages.

From his study of oils in different plant species the writer has devised a theory which he calls that of "physiological characteristics." Where the morphological characteristics tend to become modified and eventually to give rise to new species, the physiological characteristics are more independent of environment and tend to stability. The physiological characteristics may thus be regarded as themselves constituting a specific character and would occur in practically identical form in closely related species or at most very slightly modified by evolution. It is considered that this theory should lead not only to important deductions in botanical science but that it also holds out the prospect of building up systematic botany on the basis of vegetable physiology.

A list is given of new descriptions of oil suitable for food and industrial purposes; among the latter are the oils of the Rhamnaceae, the pine and several wild mallow plants.

Influence of Hydrogen Peroxide on Germination. DUMOUSSY, L. (*Revue de Botanique Industrielle des Semences de l'Industrie des Semences*, Vol. 196, No. 17, pp. 1-138, Paris, March 20, 1946).

Seeds of garden cress, 7 years old, put into a little distilled water but not submerged, did not germinate at 27° C. (80.6° F.), a temperature highly favourable to the development of good seeds of the same species. But in dilute hydrogen peroxide (0.6 volumes) germination begins on the 3d day, and after 10 days includes about 30% of the seeds tested. By further diluting the solution, the result is still better, with a reagent of 0.25 vol., the germinating capacity approaches 40%.

Preliminary steeping of the seeds, even for a long time, in hydrogen peroxide is insufficient; germination only takes place in the presence of this reagent, and as it is rapidly destroyed on contact with the seed, losing 10% of its active oxygen within 24 hours, it requires daily renewal.

Does the H_2O_2 act as a source of oxygen or as an antiseptic?

The old seeds brought into contact with pure water at 27° C. (80.6° F.) are rapidly attacked by micro-organisms which multiply very fast. Nothing of the kind occurs in the hydrogen peroxide. Steeping in an antiseptic solution however does not produce the same effect.

At temperatures varying from 0° to 14° C. (50° to 57° F.) the results are no longer the same. Towards the 6th day germination began in all specimens; after 15 days it averaged 25% in the pure water and 45% in the hydrogen peroxide diluted to 0.25 vol. In this way seeds of high germinating capacity in the cold, at 27° C. (80.6° F.) failed to germinate, though this temperature is very favourable to the young seeds which, within 24 hours, show embryos 2 mm. in length, whereas at 12° (54° F.) these latter are hardly apparent.

On the other hand, at a low temperature, the micro-organisms develop very slowly, only appearing towards the 6th day after the beginning of germination. This observation supplies the explanation of the above phenomena.

In the old cress seeds, the germinating energy is greatly weakened, so that development is only manifest after a comparatively long time; seeds of low vitality have to contend with their parasites. There is a fight for oxygen, and which particular seeds will survive depends on the conditions.

At 27° (80.6 F.) the micro-organisms develop rapidly (within less than 48 hours) and leave no oxygen over for the seeds, which require 4 days to germinate, germination is therefore impossible and the seeds rot. At low temperature, the position is reversed because in this case development of the micro-organisms is several days behind germination.

When the seeds are placed in hydrogen peroxide the latter reagent hinders the growth of the micro-organisms, but not that of the seeds, so that germination can take place at any temperature. The H_2O_2 at the same time acts as a source of oxygen; this results from its effect on the good cress seeds from the last crops; in the oven, the length of the embryo is perceptibly increased owing to its presence, so much so that their growth may be said to be a function of the inflow of oxygen; at a cold temperature the processes of oxidation being less rapid, the hydrogen peroxide ceases to be of use, and, being slightly toxic, it may even retard germination slightly.

A last observation goes to bear out the accuracy of this interpretation. The old seeds above mentioned, which fail to germinate in pure water at 27° C. (80.6° F.), germinate at that same temperature to the extent of 25% when placed in wet sand; the reason is that the aeration surface is the larger and the access of oxygen easier.

It follows that tests of germinating capacity carried out in propagating-pans may lead to the condemnation of seeds which, when placed in the ground, would prove of medium quality. This is a conclusion already arrived at in practice, particularly as regards beet seeds.

628 - **Fluorine in the Vegetable Kingdom.** - GAUTIER, A. and CLAUSMANN P., in *Comptes rendus de l'Académie des Sciences*, Vol. 162, No. 3, pp. 105-112, Paris, January 17, 1916.

In previous publications the methods have been discussed by which the Authors have been able to make a quantitative determination of the fluorine present, even in traces, in minerals, water, and living tissues of plants. Fluorine is found to exist in all animal tissues, but in very different proportions, and in two forms at least; in tissues cutaneous in their nature of relation, the life of which is obscure (the epidermis, the enamel of teeth, nails, body hair, scalp hair, etc.) the fluorine is abundant and may exceed 180 mgms. per 100 grms. of dry tissue. On the other hand, in tissues of high vitality, barely 1 to 4 mgms. of fluorine per 100 grms. of dry substance are found. Finally, in tissues of medium vitality (bones, tendons, cartilages, etc.), the fluorine shows an intermediate proportion.

In all cases fluorine is accompanied by phosphorus, and, though not proportional to this latter, increases or declines with it. While in tissues of intense vitality and rapid metabolism however, only 1 to 4 parts of fluorine are found as compared with from 350 to 1500 parts of phosphorus.

(1) *Comptes rendus de l'Académie des Sciences*, vol. 154, 1912, pp. 1469, 1670, 1735, 26.
Bulletin de la Société chimique, Series 4, vol. II, p. 875. (Ed.).

in tissues the life of which is more obscure, and which serve for mechanical protection or ornamentation, and are eliminated from the organism direct without change of form (epidermis, hair, nails, etc.) 1 part of fluorine is found to 3.5 parts only of phosphorus, these being the same proportions as found in mineral fluorophosphates such as apatites. In proportion, therefore, as the ultimate particles ("micellæ") of tissue with highly specialised vital processes (muscles, glands, etc.) function and break down so the fluorine, initially occurring in highly complex forms in which its mode of combination with phosphorus could not be discerned, becomes gradually concentrated and increases in amount relatively to the latter element, until finally, in the dermal products (body and scalp hair, feathers, nails, etc.) which are ultimately detached or eliminated, the ratio $\frac{P}{F} = 3$ to 5, which is that of fluorophosphates, is reached, i.e. the fluorine has passed into the mineral form no longer utilisable by the animal system (1).

These observations, which summarise the results of the lengthy labour of investigation of the state of fluorine in animal tissues, led to the same studies being undertaken in plants. Do all the latter necessarily contain fluorine? Is that element fixed more particularly in any given organs of the plant? Do fluorine and phosphorus always occur together in the plant tissues and do they vary in the same direction? Are there any plants or plant families having special need of this element? These questions are partly answered by the researches herewith.

With a view to ascertaining the changes through which fluorine passes from plant to animal, the element was particularly sought in vegetables or parts of them used for the food of man and herbivorous animals: wheat, barley, oats, fruit, pulses, hay, straw, etc., and, by way of supplementing these: young leaves, wood, bark, etc. care being taken always to make a quantitative valuation of the phosphorus in the same specimens while this was done for fluorine.

The Table here appended indicated the percentages found. The fluorine and phosphorus are always given in milligrams in reference to 100 grams of vegetable tissue fresh or dried.

From these experimental data the following few conclusions may apparently be drawn:

The leaves are the organs richest in fluorine. From 7 to 14 mgms. of this element are found in 100 gms. of leaves calculated as dry: lucerne 5.65 mgms., sainfoin 7.25 mgms., sorrel 13.87 mgms., chicory 5.88 mgms., spinach 3 mgms., dandelion 8.20 mgms., beetroot 13.40 mgms., mustard 16.80 mgms. In these leaves the proportions of phosphorus are, generally speaking, high relatively to the rest of the plant: lucerne 1.5 mgms., chicory 70.2 mgms.

(1) On this subject see the papers by the writer in: *Comptes rendus de l'Académie des Sciences*, vol. 156, 1913, pp. 1317 and 1425; vol. 157, 1914, p. 541. — *Bulletin de la Société Chimique*, Series 4, vol. 13, p. 1018; vol. 15, p. 241. — *Bulletin de l'Académie de Médecine*, Series 2, vol. 4, 71, p. 63. (F.C.).

*Comparative Table of the Quantities of Fluorine and Phosphorus
in various Plants and their Products.*

Nature of Product	Fluorine per 100 gms. of fresh substance	Fluorine per 100 gms. of dry substance	Phosphor. per 100 gms. of dry substance	Ratio P F	Remarks
	mgms	mgms	gms	mgms	
<i>Gramineae:</i>					
Wheat (flour) . . .	0.83	1.00	150	150	Lime-stone soil of Champagne.
" (bran) . . .	0.59	0.68	1 080	1 588	
" (flour) . . .	1.17	1.41	131	95	Granitic soil of Brittany
" (bran) . . .	0.36	0.42	1 102	2 623	
Other wheat flour. .	0.71	0.89	—	—	Lime-stone soil (Marna)
Rye (flour). . . .	0.52	0.61	176	286	
Barley (flour). . .	2.0	2.20	—	—	
Rice	0.80	0.94	101	107	Not in husk.
<i>Leguminosae:</i>					
Haricots	1.70	2.18	530	252	Seasons beans.
Lentils	1.56	1.80	500	277	
French beans . . .	0.019	0.21	—	—	Edible pod.
Lacine	1.30	5.65	318	50	Stalks and leaves
Sainfoin	2.72	7.25	167	43	Stalks and leaves.
<i>Cruciferae:</i>					
White-headed cabb. .	0.088	1.08	—	—	Green cabbage.
Cauliflower	0.21	2.57	—	—	Cabbage head.
Turnip (roots) . . .	0.14	2.02	—	—	Paris turnip.
Radish (roots) . . .	0.06	2.00	769	381	Small red radish.
Cress	0.093	1.34	—	—	Leaves and stalks.
Long radish	0.24	1.20	268	223	
Mustard (seeds). . .	1.45	1.58	—	—	Black mustard.
" (leaves)	0.76	6.80	383	56	
<i>Diplostaxis</i>	0.010	0.059	—	—	Whole plant.
<i>Rosaceae:</i>					
Pear (pulp)	0.022	0.17	—	—	"Passe-crassane" variety
Apple (pulp)	0.034	0.21	63	300	
" (rind)	0.76	2.78	83.7	30	
Peach (flesh)	0.29	3.03	219	55	
" (stone)	0.74	2.60	—	—	
Apicot (flesh) . . .	0.30	2.50	157	62	
Cherry	0.37	3.70	159	43	Flesh and skin
Strawberry	0.12	1.40	—	—	
<i>Solanaceae:</i>					
Potato (root) }	0.084	0.30	—	—	"Stark's" large " variety (Without skin.
Potato (flour) . . .	0.158	0.18	80	114	
Tomato (fruit) . . .	0.20	4.00	—	—	
<i>Polygonaceae:</i>					
Buckwheat (flour) .	2.17	2.53	—	—	
Sorrel	0.08	1.387	621	45	Leaves.
<i>Synanthropeae:</i>					
Chicory	0.32	5.88	702	110	Leaves.
Dandelion	0.07	8.20	101	50	Leaves

*Comparative Table of the Quantities of Fluorine and Phosphorus
in various Plants and their Products. (continued)*

Nature of product	Fluorine per 100 gms. of fresh substance	Fluorine per 100 gms. of dry substance	Phosphorus per 100 gms. of dry substance	Ratio F P	Remarks
	mgms.	mgms.	mgms.	mgms.	
<i>Umbelliferae:</i>					
Carrots	0.036	0.34	—	—	Root
<i>Liliaceae:</i>					
Asparagus	0.52	7.91	7.36	94	Young shoots or suckers
<i>Chenopodiaceae:</i>					
Spinach	0.37	3.00	—	—	Young leaves
Beetroot	1.00	13.4	100	100	Leaves
<i>Mulaceae:</i>					
Cashew	1.04	1.78	22.1	125	Husked bean
<i>Rubiaceae:</i>					
Green coffee	1.20	1.45	327	225	Unroasted berries (Mattioli)
<i>Ampelidaceae:</i>					
Grape	0.12	0.81	—	—	Black grape (grape without stalk)
<i>Moraceae:</i>					
Fig	0.27	1.98	—	—	Fresh fig
<i>Juglandaceae:</i>					
Walnut	0.68	0.78	—	—	Kernel
<i>Musaceae:</i>					
Banana (pulp)	0.07	0.38	—	—	Ripe fruit
" (skin)	0.50	5.10	—	—	do
<i>Acotyledons:</i>					
Fern	2.70	8.50	12.1	1.11	Made from whole herb
Cultivated mushroom	0.81	8.40	1.23½	11	Fresh
Edible toadstool	0.052	0.61	—	—	Fresh
<i>Other vegetable products:</i>					
Stalks, straw, food, bark	0.40	—	—	—	Chaff from ripe grain crops
Hay	0.04	1.01	—	—	Ordinary state each used in the crucible with NaKCO ₃
Wheat straw	0.34	0.40	—	—	
Poplar (wood)	0.34	0.45	20	11	
" (bark)	1.30	1.40	13	13	
Pir (wood)	1.45	1.75	20½	14	
Pine (wood)	0.59	0.66	—	—	
Oak (wood)	0.48	0.50	4.65	7.4	
" (bark)	1.04	1.40	13.5	31	
Birch (wood)	5.00	7.40	17.4	2.3	Experiment to be repeated
" (bark)	0.31	0.30	—	—	
Walnut (wood)	0.60	0.71	8.7	12	
" (bark)	0.32	0.37	16.5	11	

sorrel 612 mgms, dandelion 464 mgms, beetroot 490 mgms, etc. dry, per 100 grams of leaves dried at 100° C.

The *buds* (cauliflowers and asparagus) are slightly poorer in fluorine, 2.57 mgms and 7.94 mgms to 100 grams of dry parts. The quantity of phosphorus was only ascertained in asparagus, where it reaches the high amount of 76 mgms per 100 gms.

The stalks, wood and bark are the parts poorest in fluorine, the latter ranging from 0.26 to 1.7 mgms per 100 gms. As expected, these tissues are also poorest in phosphorus: acacia wood 8.7 mgms, fir 1.3 mgms, poplar bark 25 mgms, poplar bark 20 mgms, birch bark 17.4 mgms, per 100 grams dry.

The edible roots examined contain fluorine and also phosphorus in very variable proportions: *Fluorine*: carrot 0.24 mgms, turnip 2.02 mgms, radish 2 mgms; *Phosphorus*: radish 769 mgms, long radish 268 mgms per 100 grams dry.

Pulp Fruits (edible part) are moderately rich in fluorine: peach 3.0 mgms, apricot 2.50 mgms, cherry 3.70 mgms, tomato 4.06 mgms. The phosphorus contents are medium: peach 219 mgms, apricot 157 mgms, cherry 159 mgms, apple 63 mgms, per 100 gms in the dry state. In any particular fruit (apple, banana), again dry, the pulp is poorer in fluorine than the skin.

The quantities of phosphorus also increase in the skin or epidermis of fruits and seeds as compared with the edible parts.

In the seeds the quantities of fluorine are medium, and comparable with those found in the pulp of edible fruits. They vary but little, and independently of the family, as shown by the following figures.

	Flourine per 100 gms. dry —	
Wheat flour (according to origin)	1.1-1.11	megms.
Rye	0.60	
Buckwheat	2.53	
Barley	2.20	
Rice	0.91	
Haricots	2.10	
Lentils	1.80	
Mustard (seed)	1.35	
Cacao (husked)	1.78	
Coffee (green)	1.13	

Granitic soils tend to increase the fluorine contents of grain.

The episperm of the wheat grain (bran) is very poor in fluorine (0.4 mgms to 0.68 mgms per 100 gms of bran), but very rich in phosphorus (1080 mgms to 1102 mgms). This quite unexpected observation will require confirmation by other samples of other cereals. The flours supplied by these grains are generally, like the fruit pulp, moderately rich in phosphorus (wheat flour 134 mgms and 150 mgms per 100 grams dry; rye flour 176 mgms rice flour 108 mgms).

In the seeds of the Leguminosae the quantities of phosphorus are high. There were found: lentils 500 mgms., haricots 550 mgms. per 100 gms. dry. These foods have long been known to be highly phosphoric.

In spite of the array of facts thus brought to light, it has not yet been possible to fix upon any vegetable group in which fluorine should appear particularly necessary and abundant. This is evident from the above Table, in which the results are grouped according to natural families. Nevertheless it is true that in each of them very dissimilar plant organs have been comprised: fruits, leaves, stalks, roots, etc., which have been seen to possess very different content of fluorine in one and the same plant.

For the different organs of the same plant no simple law can be detected connecting the variations of fluorine with those of phosphorus. As in animals, however, these two elements mostly increase or decrease

together. For the same kind of tissue the ratio $\frac{P}{F}$ appears to vary more in the plant than in the animal. It is also observed that this ratio $\frac{P}{F}$ which varies from 350 to 700 in most animal tissues of intense life, is generally much below these figures in vegetable tissues, even where life is most active.

24 - Comparative Tests of 3 Varieties of Rye at Toresterp, Sweden. H. HANSEN, *von PEHLIZEN*, in *Steniska Meddelanden*, no. 1, 1912, Vol. XXX, No. 1, pp. 1-8. Jonköping, 1912.

These cultivation trials in boggy land at the agricultural Station of Toresterp during 1910 to 1914 were for the purpose of comparing the varieties "Petkuser", "Grågrå" (grey rye) and "Midsommar". The manure used per acre was: stable manure about 14³/₄ tons. Basic slag 5.0 cwt., potassium salt (37 %) 3.9 cwt. The rye generally showed great resistance to winter weather, the one exception being in 1910 when late frosts killed the flowering rye, destroying almost the entire crop.

The appended Table contains the results of the trials.

Disregarding 1910, it is evident that in the most favourable years for rye growth the variety "Petkuser" gave a yield higher than that of the two native varieties; in 1913 and 1914 on the other hand, the winter having been very severe, with frequent frosts, the varieties "Midsommar" and "Grå" proved superior to the "Petkuser" owing to their greater resisting powers.

As to the yield of straw, the native varieties produced much more than the "Petkuser", which was in turn distinguished by high weight of grain.

"Petkuser" may be advantageously grown in places not much exposed to wind and frost, that is, whenever no special resistance to very low temperatures is needed. For the purposes of such resistance along with good cropping power, the varieties "Grå" and "Midsommar" should be chosen.

Results of Tests.

Varieties	1910	1911	1912	1913	1914	Average of 1910-1914
<i>Yield of Straw in lbs. per acre</i>						
Petkuser	4 400	5 025	5 873	4 071	3 730	4 771
Grå	5 022	5 670	5 772	4 420	6 811	5 671
Midsommar	5 541	5 938	6 256	4 494	5 795	5 640
Averages	5 188	5 544	5 967	4 330	5 148	5 352
<i>Yield of Grain in bushels per acre (bushels of 60 lbs.)</i>						
Petkuser	5.36	15.50	50.66	24.78	25.93	30.1
Grå	4.77	41.31	30.63	29.00	41.77	38.68
Midsommar	4.11	41.65	15.96	23.38	36.03	37.50
Averages	4.76	44.82	15.42	25.38	34.57	37.65
<i>Weight of 1000 grains in grams</i>						
Petkuser	18.1	34.0	28.4	27.9	25.3	28.5
Grå	12.2	21.8	17.4	20.9	18.0	19.1
Midsommar	12.2	22.1	17.4	19.9	17.8	19.1
Averages	14.2	26.0	21.1	22.9	20.4	22.1
<i>Weight per bushel in lbs.</i>						
Petkuser	45.6	57.1	52.9	50.4	57.0	54
Grå	46.5	50.1	54.0	52.7	58.1	55.0
Midsommar	46.8	58.8	51.0	50.2	56.6	51.1
Averages	46.3	58.3	53.6	51.5	57.2	55

030 **Comparative Tests of 9 Varieties of Oats at Torestorp, Sweden.** - HJALMAR FELLITZEN, in *Svenska Mosskulturförbundets Tidskrift*, Vol. XX, No. 1, pp. 1-10, Jönköping, 1916.

In these comparative tests covering the period 1909 to 1914, 5 varieties of white oats were cultivated: Guldregn, Dala, Ligowo, Leger, Probst and 4 of black oats: Klock, Plym, Mesdag and Tysk Mosshafre (German oats for peat-bogs), a standard phospho-potassic dressing being applied them every year.

The results of the tests are contained in the following Tables.

Results of 1938

	1939	1940	1941	1942	1943	1944	Average	Averages of years showing results for Golden-regen	Relative average yield Golden-regen standard
<i>Yield (Straw, bushels per acre)</i>									
<i>Light varieties</i>									
Golden-regen	5 782	5 445	5 232	5 805	6 220	4 962	5 581	—	5 581
Dala	—	—	—	5 021	5 010	3 708	5 082	3 692	40.6
Lagowo	5 123	4 513	—	—	—	—	4 818	5 588	48.3
Loar	5 750	5 302	5 052	6 325	6 510	4 344	5 661	—	4 754
Probsteier	5 155	5 234	5 210	4 780	5 805	4 341	5 130	—	6 028
<i>Dark varieties</i>									
Köck	3 911	3 453	5 378	6 004	6 174	4 488	4 688	—	4 003
Köck Mosshafre	3 453	2 571	4 702	4 260	5 025	3 821	3 986	—	4 050
Pyra	4 023	3 010	—	—	—	—	3 811	5 088	58.1
Weslag	30 54	2 102	5 080	—	—	—	3 018	3 403	3 603
Average	4 710	3 918	5 211	5 027	5 603	4 277	4 441	5 060	38.17

<i>Yield (Triticum, bushels per acre)</i>									
<i>White varieties</i>									
Golden-regen	30	58	86	70	40	61	60	—	60
Dala	—	—	—	63	55	51	56	60	40
Lagowo	10	41	—	—	—	—	10	40	40
Loar	35	55	74	14	42	30	48	—	48
Probsteier	42	42	62	51	37	53	48	—	48
<i>Dark varieties</i>									
Köck	32	15	60	03	51	48	32	—	42
Köck Mosshafre	36	30	67	66	12	12	17	—	17
Pyra	29	16	—	—	—	—	38	40	40
Weslag	37	24	69	—	—	—	13	50	13
Average	36	42.6	60.3	50.5	17	49.10	48	57.25	49.77

<i>Height (1000 grains in cm)</i>									
<i>White varieties</i>									
Golden-regen	22.5	32.1	26.1	25.7	27.0	20.5	28.1	—	28.1
Dala	—	—	—	23.2	20.3	20.5	25.3	28.0	25.1
Lagowo	27.1	37.8	—	—	—	—	35.0	27.1	33.4
Loar	23.0	35.5	33.0	25.1	27.5	17.5	29.9	—	29.0
Probsteier	27.2	32.9	34.1	28.1	26.6	22.5	30.2	—	30.2
<i>Dark varieties</i>									
Köck	21.9	32.0	27.0	25.1	29.1	27.5	27.1	—	27.1
Köck Mosshafre	20.4	30.1	30.2	27.9	24.6	25.6	27.0	—	27.0
Pyra	20.3	30.1	—	—	—	—	24.2	25.4	25.5
Weslag	27.7	30.0	32.5	—	—	—	30.4	28.1	30.4
Average	24.7	32.7	31.2	25.8	26.9	26.0	28.5	—	28.7

<i>Percentage of grains</i>									
<i>White varieties</i>									
Golden-regen	61.6	73.6	60.6	69.9	66.8	75.5	70.0	—	70.0
Dala	—	—	—	65.1	64.8	71.1	67.0	70.7	66.3
Lagowo	64.1	72.5	—	—	—	—	68.4	60.1	69.4
Loar	61.9	72.4	63.9	60.0	64.0	71.2	65.1	—	65.4
Probsteier	61.0	73.7	67.1	60.2	61.4	73.0	68.7	—	68.7

Results of tests.

	1909	1910	1911	1912	1913	1914	Average	Average of years showing results for Goldenregn	Rel. av. for 1909-1914
<i>Black varieties.</i>									
<i>Percentage of grains.</i>									
Klock	63.5	69.5	63.1	69.7	66.8	71.6	67.4	—	67
Tysk Mosshafre	70.1	71.9	68.3	71.7	61.3	70.5	69.0	—	69
Plym	61.6	70.2	—	—	—	—	65.9	69.1	67
Mesdag	72.0	71.3	69.2	—	—	—	70.8	69.3	71
Average	65.3	71.9	66.9	67.6	64.5	72.3	68.1	—	68
<i>White varieties.</i>									
<i>Weight per bushel (lbs.).</i>									
Goldenregn	32.1	37.9	38.0	32.9	32.1	38.9	35.3	—	35
Dala	—	—	—	—	31.5	34.0	38.5	34.6	34
Ligowo	32.1	36.0	—	—	—	—	31.0	34.9	34
Leger	29.5	38.8	37.3	27.0	30.6	38.0	33.5	—	33
Probsteier	31.2	34.8	35.5	28.5	28.8	31.9	32.6	—	32
<i>Black varieties.</i>									
Klock	31.3	38.5	33.6	30.2	31.6	36.0	33.6	—	33
Tysk Mosshafre	36.5	37.9	35.0	32.5	30.6	35.7	34.8	—	34
Plym	29.0	37.2	—	—	—	—	33.3	34.9	33
Mesdag	38.8	38.5	37.3	—	—	—	38.5	36.0	38
Average	32.65	37.45	34.2	30.43	31.3	35	34.47	34.1	34
<i>White varieties.</i>									
<i>Number of days between sowing and earing.</i>									
Goldenregn	72	74	66	70	—	—	70	—	70
Dala	—	—	—	67	—	—	(67)	70	67
Ligowo	72	74	—	—	—	—	(73)	73	72
Leger	73	74	68	72	—	—	72	—	72
Probsteier	75	74	71	75	—	—	74	—	74
<i>Black varieties.</i>									
Klock	73	—	71	74	—	—	73	69	74
Tysk Mosshafre	59	—	60	65	—	—	61	69	62
Plym	73	—	—	—	—	—	(73)	72	71
Mesdag	59	—	60	—	—	—	(59)	69	60
Average	60	74	66	70	—	—	—	—	69
<i>White varieties.</i>									
<i>Length of vegetative period (days)</i>									
Goldenregn	123	130	102	120	120	107	117	—	117
Dala	—	—	—	109	114	94	(106)	116	(107)
Ligowo	123	130	—	—	—	—	(126)	126	(117)
Leger	123	130	109	126	120	112	120	—	120
Probsteier	123	130	109	130	123	112	121	—	121
<i>Black varieties.</i>									
Klock	118	114	109	125	120	103	115	—	115
Tysk Mosshafre	106	114	98	109	114	89	105	—	105
Plym	118	114	—	—	—	—	(116)	126	(106)
Mesdag	106	114	98	—	—	—	(106)	118	(103)
Average	117	122	104	120	118	103	—	—	115

The climate of Torestorp, with its frequent spring and autumn frosts, anything but favourable to the growth of wheat, but in spite of this crop was really good in some years. Thus, in 1911 and 1912, 2 044 and 2 060 lbs of grain per acre were obtained; in 1914, 1913 and 1910, 2 052, 2 062 and 1 784 lbs respectively; on the other hand, in 1909, the yield was only 1 517 lbs.

As regards the respective values of the different varieties compared, the "Guldenregn" undoubtedly takes the first place, with a six-yearly average of 2 498 lbs of grain per acre. Extremely encouraging results were also obtained with the "Dala" variety selected at Svalöv and tested 1912-1913-1914; on the other hand the "Probsteier", except in the years 1909 and 1914, was found unproductive and certainly incapable of any higher competition with the best white oats particularly suited for peaty soils; the same may be said of the "Leget".

Among the black varieties "Klock II" leads, being superior to "Medag" and "Mosshafre" (oats for peaty soils); the last two, on the other hand, possess great resistance to frost and thrive even in the worst wet soils.

The quality of the grains generally leaves much to be desired, owing to the spring frosts; the weight of 1000 grains is always very small, as is also the percentage of grains; on the other hand, the yield of straw is good, with a maximum of 50 cwt. for the "Leget" variety. "Medag" and "Mosshafre" are the earliest varieties, "Leget" and "Probsteier" the next, while "Klock" and "Guldenregn" occupy an intermediate place, with a growing-period lasting on the average 115 to 117 days respectively.

In conclusion, it may be stated that the most suitable variety for the local soil and climatic conditions of Torestorp is beyond all doubt the "Guldenregn", which is marked out by high yield of grain and straw and good quality of the grain.

1. Cross between a Wild Crucifer and a Cultivated Crucifer with Tuberised Root.

BROCARD-KIOLLE, in *Comptes Rendus Séances Acad. Sciences et Acad. Agriculture, Paris*, Vol. 162, No. 14, pp. 811-816, Paris, April 1916.

It is easy to produce hybrids between the wild *Raphanus raphanistrum* and the different varieties of *Raphanus sativus* L. The plants described by several writers as intermediate between these two species are nothing but their crosses.

The hybridisation of a wild plant (*R. raphanistrum*) with a cultivated plant (*R. sativus*) yielded the same products in the 1st and 2nd generations as the reverse cross. In these species *Raphanus*, therefore, the difference of the sexes does not make itself felt in hybrids.

The first generation of these crosses yielded plants all of which were similar and more or less intermediate between the parents.

In the 2nd generation these self-fertilised hybrids segregated. An average of 65.75 % of the plants obtained were tuberised, 5 to 15 % had reverted to the cultivated type; an average of 34.25 %, on the contrary, remained to the wild type; the rest of the plants retaining mixed characters.

The seeds of one and the same hybrid pod produce plants differing profoundly from each other.

When the wild plant is crossed with a hybrid of different variety of the cultivated plant, the 2nd generation of the resulting hybrid includes both the wild plant, the cultivated cross, intermediate plants and plants recalling the origin of the cultivated cross. Thus, a yellow radish cross with *R. raphanistrum* yields, in the first generation, plants with black tubers and in the second generation plants with yellow, black, white, and black tubers and the pure wild form.

From these facts the following conclusions are drawn:

1) Hybridisation is an excellent means for artificially inducing a wild plant.

2) In the hybrid between a cultivated and a wild plant, the wild type tends to become dominant in the progeny of the hybrid plants. This readily explains why a large number of wild forms is sometimes found in the vicinity of an abandoned radish field. There is no degeneration of radish, but a plentiful reversion to the wild species in consequence of crossing.

In the struggle for life, therefore, the more perfect species is at a disadvantage.

632 **Breeding Farm Crops in Iowa, United States.** HUGHES H. D., in *Transactions of Heredity*, Vol. VII, No. 3, pp. 113-121, Washington, March 1926.

1) *Oat Breeding.* The present experiments in oat breeding were begun in 1906 (in cooperation with the Bureau of Plant Industry, United States Department of Agriculture). The work consists primarily in isolating and testing pure lines from commercial varieties, and secondly in breeding pure lines from crosses.

Several hundred pure lines have been isolated annually from various commercial varieties. These pure lines have been tested for growth vigour and productivity. Those which appeared most promising were bred and tested under field conditions. In all, over 8,000 pure lines have been isolated and tested from 1906 to 1914. 125 pedigree varieties are included in the variety tests. Two of the most promising have been distributed to farmers in sufficient lots to plant one acre of each, the pedigrees being compared under field conditions with the best commercial varieties which the farmers have been able to secure. In 1914 the pedigree varieties "Iowa 103" and "Iowa 105" each outyielded the commercial varieties by more than 4 1/2 bushels per acre. Prior to 1908, Dr. J. NORTON of the "Bureau of Plant Industry" made a large number of crosses. The product of these crosses was transferred to the Experiment Station in 1909. Several thousand selections have been made and tested in the nursery. The most promising of those that have proved to be pure lines have been bred and are being tested in the variety test plots and comparisons made with commercial varieties and of pure lines.

2) *Winter Wheat Breeding.* This project started from a foundation stock of eleven different varieties in 1906. From these, several hun-

lines have been selected and tested out annually in head and nursery rows. During the past four years at least 500 heads have been secured from fields away from the Station. During the years 1900 to 1914 approximately 8000 pure lines have been tested out and either bred out or discarded. Some 150 pedigree strains are under comparison in plots of one twentieth-acre and others are being compared in tenth-acre plots. Seed sufficient to plant one acre of the two most promising and best yielding varieties, "Iowa Nos. 404 and 327", have been distributed to 50 of a number of farmers in various portions of the State, these to be compared with a plot of similar size planted under the same conditions, using the best commercial seed which they could get. In 1914 these pedigree varieties outyielded the commercial sorts by an average of one and a half bushels per acre.

3) *Barley Breeding*. This project was begun in 1911, the object being to produce strains or varieties of barley suitable for brewing purposes and which could be successfully grown on the dry soils of Iowa. The most promising pure lines are now being tested out in head and nursery rows.

4) *Breeding Silver King Maize for Northern Use*. This work was begun in the spring of 1910, when 300 of the best ears of Silver King maize which could be secured were planted in ear to row trials. During the five years 1910 to 1914 over 1,000 ears have been tested out in this way. Approximately 10 per cent. of the mother ears showing the best performance have been sown in the crossing plots, the best of these crosses being bred and tested in the field. Some 57 crosses have been tested out at the breeding stations and the progeny of about 10 of these crosses has been distributed to several hundred farmers in the northern part of the State for comparison with their own corn. In 1914 the improved Silver King outyielded all varieties with which it was compared by an average of approximately five bushels per acre.

5) *Reid's Yellow Dent Breeding Work*. From 1905 (the year when the work was begun) to 1914 over 2,000 selected ears of Reid's Yellow Dent maize have been tested out in ear to row plots. The ears showing the best performance are carried over each year to go into the crossing plot.

One very desirable strain known as "Iowa 204" has been developed which, in test trials, has an average of about 12 bushels per acre over ordinary Reid's from which it came. Enough corn to plant one acre was supplied last year to each of several hundred farmers in central Iowa for comparison with their own corn.

6) *Breeding Red Dent Maize*. This investigation, to determine the heredity of the colour character in Reid's Yellow Dent Corn (Red and Blue) began in 1913, and has therefore only been under way for two seasons.

7) *Correlation Studies with Maize*. The object of this investigation is to determine the relation between the ear characteristics of seed ears and also the relation between the stalk characteristics of the plant producing the seed ear and the yielding power of the ear. This part of the work is begun in 1907. Though few of these data have been compiled, it is

believed that some rather striking correlations between the character of the stalk and the yielding power of the ear will be found.

8) *Clover Breeding*. This project was begun in 1910 (in cooperation with the Bureau of Plant Industry, United States Department of Agriculture), when a large number of selections were made from specimens secured in the vicinity of Ames, Iowa. In 1912, various lots of seed coming from all parts of the world were secured from the Bureau of Plant Industry of the United States Department of Agriculture. These were planted in nursery plots where individual plants were seeded and the best individuals isolated for continued breeding and selection. Some fifty-five of the best individuals have been multiplied and are being compared for vigour, leafiness, seed production, and resistance to winter cold and disease.

CEREALS
PULSE
CROPS

633 - *Wheat Varieties in Siberia* (1). — FLAKSBERGER C. in *Trudy na Prikladnuyu Botaniku* (Bulletin of Applied Botany), Year VIII, No. 7, pp. 837-860. Moscow, in English, pp. 861-862. Petrograd, 1915.

The most widely distributed wheats throughout all Siberia are *Triticum vulgare* Vill. vars. *ferrugineum* Flaksb., and *lutewense* Flaksb., then *erythrospermum* Körn. and *milturum* Al. In cultivation these forms occur in mixtures. Occasionally some of them predominate in the crop, but there also cases where no predominance could be observed. As admixtures there are found *Tr. vulgare* var. *gracuum* Körn. (from Turkestan), *leucospermum* Körn. (seldom), *hostianum* Clem. (from Turkestan), *fuliginosum* Al. (very seldom, from Turkestan), *caesium* Al. (local form), *alberubrum* Al. (seldom), *albidum* Al. (seldom), *barbarossa* Al. (very seldom, from Turkestan), *nigroaristatum* Flaksb. (local form), *sardoum* Körn. (seldom).

As predominant forms are cultivated around Toboljsk and Tomsk (except in the northern part): *Triticum durum* Desf. vars. *hordeiforme densiculatum* Flaksb., *hordeiforme laxiusculum* Flaksb. In the same locality can be found *Tr. durum* var. *coeruleescens* Bayle as a predominant form in the field crop. The same is to be said of the distribution of *Tr. durum* var. *melanopus* Al. in Akmolinsk and Semipalatinsk provinces. This variety is found in the governments of Toboljsk and Tomsk, in sometimes considerable amounts.

Tr. compactum Host var. *icterinum* Al. is to be found throughout Siberia mixed with other varieties, but is almost never found as a predominant form in the crop. As a mixture can be found: *Tr. compactum* vars. *erinaceum* Desv. (Turkestan); *jetisowi* Körn. (found separately, from Turkestan); *creticum* Mazz. (found separately). It is to be generally observed that the cultivation of *Tr. compactum* Host in Siberia is now replaced by that of *Tr. vulgare* Vill.; *Tr. turgidum* L. vars. *lusitanicum* Körn. and *plinianum* Körn. are to be found among the crops of several farmers in different provinces.

Tr. polonicum L. var. *villosum* Desv. is found among crops of several

(1) See also B. Dec. 1915, No. 1270.

mers. *Tr. spelta* L. is not to be found in Siberia. *Tr. dicoccum* Schrank and *T. farrium arras* Hoscht. and *rufigum maturatum* Fluksb. are to be found, though very rarely. *Tr. monoeccum* L. is not to be found in Siberia.

3. **Growing Manitoba Wheat in the Haute-Marne, France** (1915). *Feuille d'Informations du Ministère de l'Agriculture*, XX1st Year, No. 11, pp. 13-15. Paris, 14th April 1916.

Manitoba wheat having been recommended for spring sowing in France, without any trials having been made beforehand, merely on a comparison of the weather conditions of Manitoba and France, the following is reported by M. CASSEZ, director of Agriculture for the department of Haute-Marne, deserve careful consideration:

Manitoba wheat was first grown in the Haute-Marne in 1912 on the "Ferme de la Salle" (commune of Auberive), a farm run by M. GAUVAIN, his farm, which is located close to the source of the river Aube at an altitude of 1411 ft., lies on the Lower Oolite. The soils are shallow muls, sometimes highly calcareous, on a rock or gravel subsoil. The trial made in 1912 with 4 cwt of seed was followed up in 1913, 1914, and 1915, the grain in the previous crop being sown after a preliminary cleaning only.

In 1915, sowing was done in February and March. In 1913, it had been prolonged until the 12th April, but this seems a rather late date for the Haute-Marne. The quantity of seed used was the same as that employed for the autumn sowing of the wheats "blé blanc de Lonesmes" and "Bon fermier", namely 2.67 bushels per acre. The Manitoba yielded good results, the yield being equal to that of the acclimatised variety "de Lonesmes", and always superior to that which would have been given by autumn varieties sown under rather unfavourable conditions.

Another farmer in that region, M. BÉGIN, of Vivey, had also sown 11½ bushels of Manitoba wheat on March 12th 1915. He was satisfied with the crop, although it was a little below that of the Lonesmes autumn wheat. In the strength of this result he decided to sow some Manitoba on the 20th March in 1916 in a fairly fertile soil of moderate depth, on a rocky subsoil, which had not been tilled in time for autumn sowing. Up to the present, both M. GAUVAIN and M. BÉGIN are satisfied with the growth of the Manitoba wheat on their comparatively thin and dry soils.

5. **A Remarkable Cultural Variety of Rye in the Upper Valley of Dora Riparia, Italy.** - - CERRIANA C. F., in *Il Coltivatore*, Year 62, No. 12, pp. 358-362, figs. 16 and 67, Casale Monferrato, April 30, 1916.

From Chiomonte to Onyx and from Onyx to Cesina and Bardonecchia, a variety of rye is under extensive cultivation which deserves to be brought under notice owing to its productivity, behaviour and yield of flour.

This variety differs from common rye in the following characters: culms shorter, leaves darker and wider, ears denser, grains larger and full, greenish in colour even when fully ripe, higher yield of grain (15 to 16 cwt per acre in the above region), whiter flour, furnishing a whiter bread.

This rye is sown in August or September; it germinates quickly and

1) See also *B. May* 1916, No. 519.

vigorously, and tillers plentifully, so much so as to form a bush-like growth. Owing to the climatic conditions of the above region, it is on the ground for a very long time between sowing and cropping, this time, in some localities, exceeding 12 or 13 months.

The qualities of this variety induced the Agricultural Travelling Lecturer's Institute to subject it to cultivation tests between 1906 and 1907, and then to advise farmers in the plain to sow this mountain rye. This was done by several members of the "Consorzio agrario cooperativo" of Turin, who were asked to state the results of their trials on a special day. The replies sent to the travelling Lecturer's office of Turin led to the following conclusions:

- 1) This mountain rye is a variety with high yield, extremely suitable for poor, dry and wind-exposed soils.
- 2) Put down in equal mixture with ordinary rye, it is also suitable for fertile soils, provided they are not exposed to excessive humidity and to fog.
- 3) As the characteristic qualities of this mountain rye disappear and fall off after the 2nd reproduction outside its natural environment, the seed must be renewed every 3 years.

636 - **Influence of Methods of Sowing Oats on Crop Yield; Experiments in Russia.** ARCHANGELSKI, M., in *Journal, Bureau d'Etudes de l'Agriculture Russe*, No. 1, pp. 313-318. Petrograd, March 10, 1910.

In 1914, the agricultural experiment Station of Tambov (Russia) experimented with 3 different methods of sowing: 1) broadcast; 2) ordinary sowing in rows; 3) sowing in sets of rows alternating with bare strips varying in width up to about 12 inches. The quantity of seed sown ranged from 0.60 to 1.41 cwt per acre.

The water content of the soil down to the depth of about 3 ft. was determined during the summer in order to ascertain how the various methods of sowing influence the water content of the soil and whether cultivating the bare strip helps water conservation.

Results of the Experiments - 1) With an equal quantity of seed, ordinary sowing in rows gave the largest yields, and broadcast sowing the smallest; sowing in sets of rows alternating with bare strips gave intermediate results, which were better when the strips were broad.

2) Increase in the quantity of seed used (within the limits laid down for these experiments) influenced the yield. The maximum was 1.41 cwt of seed per acre, sown in ordinary rows.

3) Periodical superficial ploughing of the bare strips ensures better conservation of soil-moisture and increases the yield.

637 - **Trials of different Varieties of Maize at the Royal School of Agriculture of Caluso, Italy.** - ROCCICCIANO N., in *Il Cultivatore*, Year 62, No. 10, pp. 307-309. Casale Monferrato, April 10, 1910.

Practical trials in a field previously under wheat. The mellow, somewhat stony soil was manured with red clover and rape plus 150 cwt of stable manure and 4 cwt of superphosphate per acre. Sowing was done at

the beginning of May, a space of 21 x 7 inches being left between sowings and the roller taken over immediately; hoeing was carried out freely in June and moulding up on the 15th June. The maize was sipped from the 8th to the 10th September. Each trial plot measured 350 sq. feet, except two of 3228 sq. feet sown with white "Varesotto" and yellow "Varesotto". After removing the spathes and properly drying and shelling the ears, the results were as shown in the following table.

Results of Trials

Varieties	Yield of grain per acre	Percentage of grain to weight	Weight of 1 bushel of grain	Height of plants	Weight of roots
	cwt.	per cent	lbs.	ft.	lbs.
Native	20	77.4	50	0.10 to 0.02	1.84
Piscedano	33	77.7	48	0.10 to 0.75	5.43
Veronese grosso	32	68.3	58	0.6 to 0.80	7.47
Pignoletto	30	74.4	50	0.10 to 0.75	5.72
White "Varesotto"	13	75.4	55	5.02 to 8.80	4.84
Yellow "Varesotto"	35	70.6	50	5.80 to . . . 58	7.50

The variety which gave the best yield therefore was the white "Varesotto", closely followed by the "Pignoletto"; their grains are heavier and more in demand. The native variety of "Veronese pipedotto" is best in yield but one of the best in point of quality of grain.

At the present price of 10s. 6d. per cwt, the crop per acre (average of all the varieties tested) represented a value of £ 17.3s. 4d. as against a cost of production (labour and manure) of £ 11.7s. per acre.

5. **Particulars of Rice-growing in Sumatra.** SMITH, M. B. in *Examination Year XXVI, Part 10, pp. 69-928*. Batavia, 1901.

The exportation of rice from Sumatra has of late years grown to be of prime importance to some parts of that island. It totals some 6,000 tons per annum, whereas in 1900 the exports were almost non-existent.

Some particulars are given as to this cultivation in Sumatra, differentiating it from the cultivation methods practised in Java.

The nursery beds are always irrigated. When transplanting the rice to the fields 10 to 20 plantlets are put down in each hole at distances of 10 to 20 inches. In Java the planting is closer (5 to 6 inches apart) and more than 5 plantlets are rarely dibbled in together. After transplanting, irrigation water is let in freely, but as soon as the secondary stalks have appeared the water is run off. After this no more irrigation water is let in until the first ears appear. As soon as the ears yellow and are nearly ripe the water is again shut out.

By this method of intermittent irrigation a more regular ripening is

secured, so that the crop can be cut with the scythe. Ripening does not take place so regularly on the permanently irrigated rice fields of Javay. The crop is then gathered ear by ear, the ripe ears being selected each time. This method entails much greater labour and time than with the scythe.

639 - **New Method of Economic Cultivation of the Potato.** — CADORET ARTHUR (Directeur des Services agricoles du Cantal), in *Le Progrès Agricole et Viticole*, Year 37, No. 1, pp. 155-156. Villefranche (Rhône), April 6, 1916.

Under present market conditions it becomes exceedingly important to obtain a normal production of potatoes with the least possible quantity of seed. Various methods are suggested for this purpose, but the facts are too often forgotten that the method must be adapted to the soil.

The writer recalls the AIMÉ GIRARD method (planting at distances of 24×24 inches of entire tubers weighing 2.8 to 4.2 ounces) which gives excellent results in well prepared, deep, fertile and fresh soils; and the CH. ALLIER method (planting at distances of 4×20 inches or 8×24 inches of 2 or 3 eye cuttings, weighing 1.76 to 2.11 ounces, from large tubers). This method, formerly adopted in the School of Practical Agriculture of Avignon (France), in irrigated soil, gave excellent results.

The writer then describes his own method, consisting in planting budding stalks instead of tubers, which he has tried in the "Ardèche" for several years and obtained good results. The tubers are sorted out and spread in a dry cellar at a temperature above 17° C. (63° F.) if possible. In a few days, before the tubers wrinkle, rooting sprouts are obtained, which must be cut before they reach a length of 8 inches.

After cutting, they must be planted as quickly as possible. The sprouts are planted in twos on the ridge sides at distances of 8×20 inches at a depth of $2\frac{3}{4}$ to $3\frac{1}{2}$ inches, according to the soil. In a few days the outside part becomes green and puts out one or two stalks, the roots taking hold at the same time. Each planted shoot gives one or two tubers which are seldom very large, but never small; a crop of nearly $8\frac{1}{2}$ tons per acre of marketable potatoes may be reckoned on. The method is applicable to all loose, light and relatively dry soils. Its advantage is that it leaves for consumption those potatoes which, on the ordinary method, would have been used for planting. The shoots given off by the potatoes on germinating keep or several days, and can be planted direct, or even forwarded some distance for planting.

640 - **Cytisus spinescens as Winter Forage.** — *El Agricultor*, Revista de Agricultura, Year X, No. 105, pp. 25-26. Ríotorto-Lugo, February 1917.

Cytisus spinescens ("aliaga" or "aulaga") grows wild throughout Spain, providing one of those rare green forages available during the whole winter. Its cultivation is advised in lands too poor for lucerne. When cultivated, it yields two crops per year, supplying from 240 to 320 cwt. of green forage per acre. The disadvantage presented by this plant is that it has prickles which it is not found possible to get rid of satisfactorily by cutters or crushers. Good results on the contrary are obtained with the centrifugal triturator and defibrator which breaks the prickles and reduces the forage to a green mass very much liked by livestock.

11 - **The Cotton Plant in the Russian Empire.** By FEFREY V. I. in *Journal of the Russian Agricultural Society* (The Agricultural Gazette), Nos. 50, 1113, and 52, 1114, pp. 137-143 and 142-1430. Petrograd, December 1913.

In Turkestan and Transcaucasia the cultivation of the cotton plant dates back to remote times, but is of very small importance. In Transcaucasia the first attempts at improvements started in the first half of the 19th century, and not till later in Turkestan. For want of co-ordination these trials had little result, and it is only 5 or 6 years since the Department of Agriculture adopted a series of thoroughly co-ordinated measures for the improvement and extension of this crop in the Russian Empire. While, up to the end of the last century, the sums appropriated in the budget for cotton-growing were ridiculously small (not exceeding £ 1 587 or £ 1 084 per annum), since 1910 they have rapidly increased, attaining in 1913 more than £ 59 524. In this way, the Department of Agriculture has been able to organise more thoroughly the institutions for experiments on the cultivation of the cotton plant, by transforming the 2 test fields already existing in Transcaucasia and Turkestan into experimental stations and further, by creating 3 new institutions in Turkestan in 1913, namely: the cotton selection Station in Fergan, the centre of the cotton region, and 2 experimental fields. In 1914 work was begun for the establishment of a Station for studying brackish soils, so that almost all the principal cotton regions of Transcaucasia and Turkestan already possess their special experimental institutions.

Side by side with the development of the experimental cotton propagation work was organised among the population and measures were taken by which the results of the experimental institutions might be applied in practice. For this purpose the staff was largely increased: in 1915 it comprised 15 specialists and 35 instructors in Turkestan and Transcaucasia. The number of demonstration fields and depots for machines to be let out on hire was increased. In addition, in order to promote the use of improved seeds, farms were established for the production of cotton seeds. The number of these farms in Turkestan alone is at present 15, with an area of 1 087 acres and an annual production of 7 873 cwt of seed, which is distributed to cotton growers. Towards 1890, the production of cotton in Transcaucasia and Turkestan was 8 786 tons, that is to say 1/3 of the total quantity required by the Russian cotton industry at that time. For the years 1911 to 1913, the comparison between the production of cotton in Russia and its importation from abroad is given by the following table:

Year.	Cotton imported	in the Russian Empire Cotton produced
1911	3 500 285 cwt	1 120 000 cwt
1912	3 530 215	1 571 960
1913	3 870 170	1 600 000

In those years, therefore, home grown cotton exceeded one half of the quantity required by the Russian cotton industry, in other words, cotton-growing in the Russian Empire developed more rapidly than the cotton industry.

Among the causes which contributed to the development of this crop in Russia there must be mentioned: agricultural measures of a technical character, railway development, influx of capital, and the irrigation works carried out after the annexation of Caucasia and Turkestan to Russia; these factors taken together afforded the possibility of irrigating about 457,000 acres. Another cause, and the one perhaps which gave the greatest impetus to the development of this crop in Russia, was, in the writer's view, the duty on imported cotton. Having been fixed in 1878 at 2 ½ shilling, per cwt of pure staple, in 1900, by gradual increases, it attained the amount of £ 1 4s. 10d.

The price of the cotton bought by Russian factories being regulated by the price of foreign, especially American, cotton, the adoption of the import duty, assessing the average yield of pure staple at 2.10-2.30 cwt per acre, meant a premium of £ 7.14s. to £ 3.2s. per acre cultivated, to the growers of Turkestan and Transcaucasia. In 1915 this protective duty was increased to £ 1 16s. 11d. per cwt.

642 - Cultivation of *Fourcroya gigantea* in the State of Rio de Janeiro, Brazil. -- FERREIRA BENTO in *O. Fazendeiro*, Year VIII, No. II, pp. 314-316, 2 figs. São Paulo, November 1915.

In 1903 the cultivation of "pita nacional" or "pita común" (*Fourcroya gigantea*) began in the state of Rio de Janeiro (municipality of Vassouras), on an area of 205 acres. In reply to an enquiry of the Ministry of Agriculture, the following particulars are given about this crop.

1 acre contains about 750 plants at distances of 5 ft. 3 in. each way. The cultivation work consists in 2 hoeings in the first year, 1 in the second, but none afterwards. The first crop was cut at the age of 5 or 6 years according to the growth of each plant. The crop is taken off twice a year, 20 leaves per plant being removed. A leaf averages 80.5 oz. in weight and furnishes on the average 1.2 oz. of fibre. One workman will cut 2,000 leaves per day. The fibre, which is used in rope making, fetches 8 ¾ d. per lb on the market in Rio de Janeiro. Tested in different European countries it was declared to be of superior value. Hitherto it has not been exported.

643 - Queensland-grown Copra. -- *Queensland Agricultural Journal*, New Series, Vol. V, Part I, p. 38; Vol. V, Part 2, pp. 98-99. Brisbane, Jan. and Feb. 1916.

An analysis of copra from coconut received from the Kamerunga State Nursery at Cairns, Queensland (1st sample) and one of commercial copra from Double Island nut, near Cairns (2nd sample) yielded the following results:

Sample	Moisture	Oil
1	5.2 %	62.8 %
2	4.7	57.8

There were also analysed separately 5 ripe and 2 green nuts from the Kamerunga State Nursery, and in the air-dried kernel there were found the following percentages of dry material and oil:

	Dry Substance	Oil
Ripe nuts	47.0-78	4.8-60.0
Green nuts	70.0-78	15.0-60.4

In sun-dried copra of different origin the average percentages of oil are:

Origin	Oil
Philippines	60.4-7
Cuba	61.0
East Indies	61.8
Mauritius	87.0

Queensland-grown copra consequently compares very favourably with that from the other principal growing countries.

Another sample of copra from nuts received from the above State Nursery at Cairns, was sent to the Imperial Institute in London for analysis. The results were: 4.4% of moisture and 64.0% of oil (yield equivalent to 67.6% of the dry copra). The oil possessed the usual character of coconut oil, and was of good quality. The copra was valued at £25 per ton by one expert and £24.15.0 by another (c. 1.1. London, October 1915), being slightly below Malabar and slightly above Zanzibar copra. It is advised that the kernel should be cut up small and better dried, reducing the moisture to 3%.

These facts completely refute the contention of certain writers that Queensland grain coconuts do not contain enough oil to have any commercial value.

¹¹⁴ - **Sesame-growing in Sicily.** CATALANO G., in *Rivista di Scienze Agrarie e di R. Giardino Coloniale di Palermo*, Vol. II, Part 1, pp. 147-151, Palermo, 1911.

The cultivation of sesame (*Sesamum indicum*) was introduced into Sicily by the Arabs about the VIIIth century A. D. and was of great importance for some time. At present it is almost exclusively confined to some districts of the province of Syracuse (Ragusa Vittoria, etc.) where it represents a part of the northern limits of this crop and is also carried on to a small extent in other parts of Europe (Malta, Greece, and Turkey). The production not being sufficient for local consumption, large quantities of sesame are imported from East Africa. The Sudan product is very much more in demand than the foreign owing to its quality and may fetch as much as £1 16s. 2d. per cwt. as against £1 8s. for the foreign. In Sicily, the seeds are used in preparing pastry, biscuits and other similar articles.

It is thought that this plant deserves to be more widely grown, and a description is given of its cultivation and the commercial treatment of its seeds as practised in the principal producing countries.

¹¹⁵ - **Thinning out *Hevea* Plantations.** HAMAKER, C. M., in *Mededeelingen van de Vereeniging Rubberproductie West-Java*, No. 2, Bandung, 1915.

A method is described for selecting the *Hevea* trees to be cut down when thinning out dense plantations.

Some planters have proposed to cut down all the trees along a given line. The writer holds that it is better to sort them out first, estimating the latex yield of each tree by tapping; an attendant catching up the latex in a glass measure. The result of the tapping is marked in yellow or red on the tree by a given sign. The trees are classified in 5 categories according to the results obtained. This trial tapping is repeated some time later, and from the accumulated marks on the tree it is easy to see whether the latter is a good producer. By getting rid of the bad producers the necessary thinning out is secured, and at the same time the average yield of a given stand is considerably increased.

Under the labour conditions in Java, the cost of porting does not exceed 8s. 11d. per acre. One labourer can tap 200 trees per day.

(16) **Relative Richness of a few Kinds of Sugarcane in Queensland, Australia.** — *Queensland Agricultural Journal, New Series, Vol. V, Part 2, pp. 100-104.*

At the request of the Mackay Manufacturers Association of Mackay, Queensland, the Central Sugar Experiment Station of Mackay in 1914 undertook comparative growing trials and analyses of crops of different varieties of sugarcane cultivated in that district; among these varieties "Cheribon" and "Oranite" form a large proportion of local production, but are not much cultivated outside the Mackay district. Month by month, from June to December, 8 to 14-month-old canes were tested both in 1914 (plant crop) and in 1915 (first ratoon crop). From two tables giving the detailed results there were obtained the averages reproduced in the following table. By early planting is meant planting in March; by late planting, planting in August. It will be seen that in both years the first three varieties clearly surpassed the last three.

Result of Tests — Average of 7 months' analyses.

Varieties	Plant crop		1st Ratoon crop			
	Early planting	Late planting	Early planting		Late planting	
	Pure obtainable cane sugar	Pure obtainable cane sugar	Pure obtainable cane sugar	Quotient of purity	Pure obtainable cane sugar	Quotient of purity
H. Q. 410	16.0%	16.6%	18.4%	91.5%	18.8%	92.5%
Bailia	15.1	16.6	19.8	92.6	18.7	91.5
Goru	13.2	13.0	17.0	90.5	16.1	89.0
Cheribon	12.6	12.6	15.6	87.4	15.5	85.6
Malabar	11.8	11.8	15.0	87.3	15.3	86.4
Oranite	11.0	11.4	15.9	88.1	15.0	86.8

17. **Absorption and Loss of Nitrogen in Java Sugar Cane Plantations after Manuring with Sulphate of Ammonia or Nitrates.** VAN HARREVELD, L. A. C. H. (in *Mededeelingen van het Proefstation voor de Java-Suikerwielcultuur, Landbouwkundig Station van Nederlandsch-Indië*, Year XXIV, Part 1, pp. 171-181, Part 2, pp. 181-190, Soerabaja, February 1926).

The question of the absorption and loss of nitrogen in the soil after the application of nitrogenous manure is of prime importance in the cultivation of the sugar cane in Java, where every year at least 50,000 tons of sulphate of ammonia are used, costing about £ 635,000 for a cultivated area of 246,954 acres.

I. In a series of specimens from different districts under sugar cane the loss of nitrogen occurring on mixing a solution of sulphate of ammonia with the soil was determined.

For the purpose of analysis 50 gms. of dry earth are first mixed with 50 cc. of water and the whole afterwards with 50 cc. of a 1% decinormal solution of sulphate of ammonia. The mixture is regularly shaken up for 2 days, then filtered, and, by distillation, the amount of ammonia in 50 cc. of the filtrate is ascertained. Multiplying by 14 the number of cc. of decinormal ammonia obtained by distillation (it should be below the limit 20), the coefficient of absorption of nitrogen is ascertained.

Analyses made show that for the majority of soils with a coefficient of absorption exceeding 140, no loss need be feared. Some lands with a coefficient below 80 might sustain a loss under particularly unfavourable circumstances, such as torrential rains or floods.

Soils of coarse texture have a low coefficient of absorption and a fairly considerable loss of nitrogen. On applying a heavy dressing of manure, the loss of nitrogen increases.

On determining the coefficient of absorption by a given soil, it may be ascertained to what extent manuring with sulphate of ammonia may be effective without entailing a considerable loss of nitrogen.

II. Contrary to the nitrogen in sulphate of ammonia, that of nitrates is not absorbed by the soil. It having been necessary, owing to the present war, to replace sulphate of ammonia by nitrates in sugar cane plantations, it was thought desirable to study the various soils utilised for sugar cane growing from the standpoint of absorption of the nitrogen from nitrates.

It was found that none of the soils analysed had any high coefficient of absorption. On subjecting the same soils with nitrate added to leaching for 3 days, a considerable quantity of nitrogen from the nitrate, it was found, had been leached out.

The conclusion drawn from the investigations is that the use of nitrate of soda in tropical countries during or before the rainy season is of no advantage. The employment of nitrate of potash on permeable, highly irrigated soils is also not to be recommended.

In Europe the action of nitrates is more rapid and effective than that of sulphate of ammonia. In the tropics, where nitrification is so rapid, this difference in the behaviour of sulphate of ammonia is unimportant.

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638 - **Judging the Quality of Tea from Certain Characters.** - DEFFES M. J. B., in *Arifin en het Prestatien van Thee*, No. 42. - BATAVIA, 1915.

A study of the chemical characters of tea was undertaken in order to ascertain whether these characters could furnish indications as to the quality of the tea. The results were not satisfactory, but some important facts were brought to light.

The determination of theine, for instance, may serve to detect adulteration. For a good quality Java tea the proportion of theine should not be below 3 %.

The percentage of mineral substances is also no basis for judging quality, as is proved by comparing the results of analyses and the prices of the same tea on the market.

A negative result was also arrived at on determining the quantity of soluble substances and tannin.

The investigations will be continued with the volatile oil distilled from the leaves of the tea.

In some European countries it has been thought that adulteration of the tea could be detected by the quantity of stalks (partly lignified) of the tea-leaves. This idea is proved to be erroneous, as many samples of superior tea of high value contained a relatively much greater quantity of leaf-stalks or fragments of young stalks than teas of poor quality.

It is concluded from these enquiries that in the case of tea, just as that of wine, tasting is so far the sole method of determining quality.

639 **Coffee tree Grafting in Java.** - VAN HEIJLIGEN W. M., in *Mededeelingen uit den Konink. Tuin*, No. 1, 11 pp., 5 figs. - BUITENZORG, 1915.

For the past few years almost all coffee-trees of recognised high quality have been grafted in the trial Garden of Buitenzorg (Java). After repeated experiments in order to make sure of having good trees to serve as grafting-stocks, the latter were confined to 2 varieties: "Excelsa" and "Dyboroskii".

For scions, preference was given to thoroughly sound terminal shoots with 5 or 6 nodes; they are cut midway through the internodes and the 2nd, 3rd and 4th pieces with node are used as scions.

The method which gave the best results was simple cleft grafting. The wound is carefully ligatured, but there is no need to cover it with mastic. The grafts are then protected against drying by enclosing them in a glass tube.

The hosts are young coffee plants about 2 feet high, topped to 25 centimetres.

The grafted plants are kept under shelter for some months before transplanting, and this system ensures 90 % of success.

The method may be simplified by using nursery plants as grafting stock.

650 - **Trials of Hop Cultivation in Italy.** - GUSELLOTTI A., in *L'Italia agricola*, Nov. 1915, No. 1, pp. 163-168, 6 figs. - PIACENZA, April 15, 1916.

In 1914 the consumption of beer in Italy was 16 207 994 gallons, of which 1 834 766 were imported from Germany and 14 350 050 of native

manufacture. For this product 322 752 cwt. of malt and 3037 cwt. of dried hops were used. The malt had hitherto been imported almost entirely from Austria-Hungary and the hops from Germany. The standard average prices per cwt. were: 10 s. for malt and £ 14 2 4. for dried hops. The value of the two imported substances therefore may be put at over £ 300 000. Adding to this the value of the imported beer, the figure of £ 480 000 is reached. The present number of breweries in Italy is 83; these figures demonstrate the economic importance for Italy of home-growing of brewing barley and hops.

With the object of encouraging the industry, the Agricultural Travelling Lecturer's Institute in Milan, in concert with the Chamber of Commerce, has encouraged a number of trials in the growing of brewers' barley by granting premiums.

The writer, who is director of agriculture for Feltre, started hop growing trials in the spring of 1914 near Pedavena (Feltre, prov. of Belluno) on an area of somewhat less than an acre. The results having been excellent, this area was doubled in 1915 and raised to 2 $\frac{1}{2}$ acres in 1916.

The loose soil was prepared at the end of the winter by deep ploughing 1 over and by digging ditches running north to south, 3 ft 3 ins. wide and 10 $\frac{1}{2}$ ins. deep, half at 5 ft and half at 6 ft 7 ins. intervals. Planting was done in the second half of March. The whole of the subsoil (about 1.82 inches) was turned over into the ditches, and short stable manure supplemented by a plentiful supply of superphosphate was spread over it. A light layer of earth was then put down, on which the pieces of germinated roots were placed at 3 ft 3 ins. distance from each other, and at once lightly covered to ensure quicker budding, which was rapid and uniform. When the young plants had reached a height of 12 ins. they were given a top dressing of sulphate of ammonia, and the earth put up in hullocks. This made the depth of the plantation about 9 $\frac{3}{4}$ ins. The after management consisted of crushing the excess of shoots at the foot, and 2 light hoeings, one in May and the other in July.

In 1914, the two early varieties originating from "Hollentauet" and "Rottenburger Frühhopfen" were used for experiment. The former having been found more adaptable as well as earlier and more productive, was alone employed in the following years. In rows 6 ft 3 ins. apart the plants were stronger, more productive and healthier than those in closer rows. It is advised that cropping should be begun at the end of August or the beginning of September, and should be carried out in several operations at intervals of 4 or 5 days. Drying is done on the hurdles commonly used for silkworms, shaking the hurdles once or twice a day and closing the windows of the premises during wet days and the night; the drying was completed by spreading the hops on the ground in these houses in layers a few centimetres thick, and stirring them gently once or twice a day with rakes or sticks. The dry hops may be either kept in heaps or put into wide-mesh sacks hung from the ceiling.

After the flowers have been gathered, the plants are cut 10 or 12 ins. from the foot. Several shoots are given off in spring from the foot of each

plant; the best of them are left for the next crop, the others being replaced with a piece of root for planting anew, or else cut flush with the ground and used as a vegetable.

A description is finally given of a reliable pole invented by the writer which has been found practical, strong and cheap.

The total cost, comprising planting, cultivation and complete picking of the first hop field of 2090 sq. yd. was £35 including the price of transport of the imported roots. The crop of dried cones was 170 lbs. in the first year and 594 lbs. in the second year; the gross profit was £22 in 1914 and £80 in 1915.

051 - **The Principal Problems in relation to Medicinal Plants and their Active Principles.** — IVANOV, in *Собрание Хорватских Академиков (Agriculture and Horticulture)*, Year LXXVI, Vol. CCL, pp. 81-107. Petrograd, January 1916.

Russia, like many other countries, was compelled by the present war to give the keenest attention to the problem of cultivating medicinal plants and improving such cultivation so as to suffice for the needs of the country. The Department of Agriculture took up the question, and in March 1915 it convened a Commission of specialists which drew up the following programme of action:

1) Publication of wall plates, propaganda pamphlets and special works on the cropping, cultivation and preparation of each medicinal plant.

2) The organisation of local lectures and consultations on the spot, especially in localities where the industry seems likely to develop or has already been developed.

3) The introduction of facts relating to medicinal plants and perfumes, allowing for local conditions, into the syllabus of temporary courses of instruction for those interested.

4) The introduction of optional instruction in the cultivation of medicinal and perfume plants in the curricula of higher Schools of Agriculture, in order to provide a specially trained staff, at any rate for experimental institutions. The Commission further recognises the necessity: (a) of encouraging the initiative of institutions and private persons wishing to devote themselves to developing the cultivation of medicinal and perfume plants; (b) to offer prizes for farms conducting such cultivation on rational methods; (c) if possible, to create, at the earliest possible moment, a body of instructors to teach the population suitable methods of utilising medicinal plants; (d) to make use for analytic investigations not only of the laboratories of agricultural experiment Stations but also of those of the Schools of agriculture and those belonging to institutions and private persons. With a view to checking the contents of active principles it has been proposed to create at least 4 experimental Stations, one in each of the following regions: Middle Russia, Southern Russia, the Caucasus and the Transcaucasian region.

The writer, adopting this programme in principle, emphasizes the necessity of vesting the duties of a central institution in one of these

Distribution of Alkaloids in some Ranunculaceae

Species	Hydrastina	Isotrypa	Acuminata	Anomura	Al. calida
<i>caesus canadensis</i>					
<i>caesus palustris</i>					
<i>caesus nupallus</i>					
<i>carabatum</i>					
<i>castratum</i>					
<i>caute nemorosa</i>					
<i>cilla pratensis</i>					
<i>clavis</i>					
<i>clavis vernalis</i>					
<i>conspicua acris</i>					
<i>conspicua</i>					
<i>convoluta</i>					
<i>convoluta</i>					
<i>convoluta vulgaris</i>					
<i>convoluta aquifolium</i>					
<i>convoluta</i> sp.....					

The sign + signifies the presence of the corresponding alcohol.

zinal plant experiment Stations in order to organise and properly co-ordinate all the scientific work, and prevent needless waste of energy.

Passing on to other problems, it is stated that in the medicinal plants industry the following 3 fundamental points must be considered, (a) cultivation of the plants; (b) rational harvesting of same; (c) exact definite determination of the active principle they contain. These 3 aspects of the problem should be considered simultaneously, as they are closely bound up with each other, and neglect of any one will involve failure. The 1st and 3rd points of the problem are gone into in detail, the necessity being shown for a systematic study of the distribution of wild medicinal plants, and it is maintained that the theory of "physiological characteristics" (1) will allow of easier solution of the problem of selecting the medicinal and perfume plants. On the ground that kindred plants secrete the same chemical compounds, this theory maintains that in kindred species the same ferment organs are to be found elaborating similar substances.

The closer akin the vegetable species, the greater the hope of finding similar elaborating organs and identical substances. This theory is of

10 See this Bulletin No. 626.

great practical importance, as it affords the possibility of easily determining in what species to look for the particular medicinal substances required, and where such search would be fruitless. The theory of "physiological characteristics" introduces a new principle, according to the writer, in the doctrine of plant cultivation, systematising investigation and indicating which plants should be tested in the first place, and what wild plants may be of use through their contents of active principles.

The appended Table brings out the importance of the theory of "physiological characters", showing that each complex vegetable substance is rarely confined to any particular species, but that in the majority of cases it occurs in several species of the same family.

In reviewing several medicinal plants demanding immediate study mention is made of the sunflower which furnishes drops advocated as an antimalarial remedy. Investigations into this substance are urgently called for, especially as the medicinal principle of this plant must be different from that of quinine.

Finally, the need is pointed out for some kind of revision of the general ideas and suggestions of popular medicine in which medicinal plants are extensively used.

- LITORE 652 — **How to obtain an Early and Abundant Crop of Tomatoes.** — BASSI E., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 16, p. 126, 2 figs. Piacenza, April 16, 1915.

The following method is advised: Sow in a hot bed at the end of January or the beginning of February; in March when the third leaf has sprouted, replant under glass frame, at 2 × 2 inches apart; early in April transplant again into small pots 3 to 4 inches in diameter, 1 plant in each pot, and put them in a frame with a southern aspect, the glass roof of which is closed and covered with matting during the night. Towards the end of April or the beginning of May, plants about 12 inches high are planted out in the open field. It is of great importance that the first topping should be at a suitable time (in many cases while the plants are still in pots), and that all the buds developing in the leaf axils should be cut away; to each bunch 3 of the young fruits first developed should at first be left, and afterwards not more than 5 or 6. By this method, with careful manuring and antifungus treatment, ripening is hastened by 12 to 15 days, and a finer and larger crop obtained.

- STRY 653 — **Composition of Fallen Leaves of Forest Trees and Their Quantities.** — MORIYASUGEMASA (Chemist of Forest Experiment Station) in *Extracts from the Bulletin of the Forest Experiment Station*, Meguro, Tokyo, pp. 28-33, Tokyo, 1915.

In many localities fallen leaves are collected and used either as fuel or for other purposes. The country people generally consider only how to use these waste products for their own profit. Such a time-honoured usage should, however, be discredited, since from the standpoint of forest economy, the fallen leaves form the principal source of nutrients for the growing trees and also exert a beneficial effect by retaining water and protecting the excessive evaporation of moisture from soil.

Leaves of a number of species grown at the Experiment Station were collected and analysed, the results being given in Table I.

TABLE I. — *Composition of Fallen Leaves of Forest Trees*

Parts of air-dried substance	Leaves					
	<i>Criptomeria japonica</i>	<i>Pinus densata</i>	<i>Liriodendron chinensis</i>	<i>Quercus serrata</i>	<i>Quercus glauca</i>	<i>Quercus chinensis</i>
Water	11.264	10.005	11.349	10.030	12.316	9.000
Organic matter	82.036	87.915	86.394	86.420	80.014	80.074
Nitrogen	0.072	0.080	0.055	1.116	0.045	1.001
Chl	0.100	2.080	2.276	3.550	6.870	0.126
Fe_2O_3	0.257	0.165	0.174	0.105	0.134	0.210
SiO_2	0.340	0.132	0.124	0.280	0.297	0.489
Na_2O	0.125	0.055	0.040	0.003	0.149	0.103
CaO	2.099	0.836	0.807	1.204	1.814	1.008
MgO	0.509	0.189	0.142	0.417	0.418	0.456
SO_3	0.082	0.053	0.055	0.088	0.005	0.126
Fe_2O_3	0.149	0.029	0.032	0.059	0.102	0.227
Al_2O_3	0.448	0.182	0.194	0.237	0.315	0.811
SiO_2	0.747	0.356	0.504	0.764	1.203	4.709

The results of the researches in the years 1911 and 1912 into the quantities of the principal ingredients found in fallen leaves per acre based on the weight of air dried leaves are given in Table II.

TABLE II. — *Weight of Principal Ingredients in Fallen leaves (per acre)*

Ingredients	Quantity of Elements	
	lbs. per acre	kg. per hect.
Nitrogen (N)	29.6	36.0
Phosphoric acid (P_2O_5)	5.1	5.1
Potash (K_2O)	4.3	9.0
Lime (CaO)	39.4	40.0

Table III gives the composition of rotten leaves.

TABLE III — *Composition of Rotten Leaves.*

Of 100 parts of air-dried substance	Akamatsu	Kumag.
Water	15.775	13.88
Dry Matter	84.225	86.124
N	1.491	1.548
Ash	27.968	17.904
P ₂ O ₅	1.648	0.190
K ₂ O	0.277	0.178
Na ₂ O	0.214	0.137
CaO	3.120	1.220
MgO	1.182	0.042
SO ₃	0.430	0.150
Fe ₂ O ₃	0.710	0.022
Al ₂ O ₃	0.080	3.850
Sand and SiO ₂	13.810	0.970

Finally, Table IV gives a comparison of the soils of wooded lands with those of the Station nursery.

TABLE IV. — *Composition of the Soils of Wooded Areas and those of Station Nursery Compared.*

Air-dried fine soil (100 parts)	Wood lot <i>Cryptomeria japonica</i>	Wood lot <i>Pinus densiflora</i>	Wood lot <i>Quercus serrata</i>	Nursery 13
Water	10.070	10.770	10.990	19.457
Loss on ignition	25.684	24.713	28.206	20.88
Total Nitrogen	0.022	0.878	0.018	0.327
Insoluble residue in HCl	10.184	54.898	51.830	49.332
Silica soluble in HCl	0.705	0.232	0.075	0.722
Alumina	7.083	7.108	14.490	12.827
Oxide of iron	7.985	4.580	5.800	10.870
Lime	0.820	2.340	0.490	0.747
Magnesia	2.931	1.327	1.943	1.72
Potash	0.155	0.217	0.213	0.027
Soda	0.240	0.324	0.252	0.37
Phosphoric acid	0.423	0.305	0.214	0.60
Sulphuric acid	0.284	0.206	0.332	0.123

A close study of the above table shows that the soils of these three wood-lands are quite different in composition. This is chiefly due to the difference of tree species, the age and closeness of the stands as well as to other forest conditions. One point common to the three lots is the richness in nitrogen, phosphoric acid, potash and lime, the lots being thus fertile as compared with the soil of the nursery bed of the Station.

The above statements will make it evident that the richness of the soil of the wood is dependent upon fallen leaves which greatly enrich originally poor soil or the land left waste for the lack of fertility. Such land will of course be considerably improved by the planting of trees thereon.

17. — **Investigation of Tree Seeds in Relation to the Place of Origin of the Parent Trees and Their Descent; and Experiments on the Preservation of the Principal Forest Tree Seeds.** — I. SHIRASAWA, II. *Experiments on the Relation of the Forest Experiment Station, Mito, Tokyo*, pp. 1-13, Tokyo, 1915. II. SHIRASAWA II. and KAWANA, *Ibid.*, pp. 15-27.

I. Research on Japanese seeds, extending over a period of 10 years from 1902 as the Japanese section of the general investigation organised by the International Association of Forest Experiment Stations. The tree species used in the experiments were *Cryptomeria japonica* Don (Sugi), *Pinus densiflora* Sieb. et Zucc. (Akamatsu) and *Pinus thunbergii* Parl (Kurotomatsu).

The following conclusions may be drawn from the results given:

1) Seeds obtained from a young seed tree (20-30 years old) are large and seedlings grown from such seeds show a better growth.

2) Seedlings from the seeds produced in localities warmer than that of the nursery, will grow better than those obtained from colder districts, so that it is always advisable to bring seeds from warmer places; if there is fear of frost, care should be taken to protect well against it. Since the seeds from warmer localities continue their vegetation later in the fall so that new buds coming late may suffer from an early frost and perish in winter.

3) Forest trees grown from seedlings originating in warmer districts than the nursery, bear many flowers and fruits in their early years. Trees grown from the seeds of a climate colder than that of the nursery bear few flowers and fruits and are very slow in growth.

As to the influence of the age of the seed-tree, old trees give rise to a smaller number of fertile seeds capable of producing saplings, but which are of slower growth. This is particularly true in the case of *Cryptomeria japonica*; but in the case of *Pinus densiflora* and *P. thunbergii*, the difference is hardly recognisable.

For the reasons above stated, the best tree seeds should be taken from a young seed-tree grown in a locality similar in climate to the place where the seeds are to be sown. (1)

II. The persistence of the germinating power of forest tree seeds varies according to species, and is influenced by the conditions under which the seeds are kept. Of the seeds tried, *Pinus thunbergii* Parl. and *Pinus densiflora*

Sieb. et Zucc. keep their germinating power best, being followed by *Leptolepis* Gord., *Cryptomeria japonica* Don. and *Cinnamomum camphora* Nees. in order, while *Chamaecyparis obtusa* Sieb. et Zucc. loses its germinating power the soonest.

The seeds of every species tried and of other similar trees are best stored in air-tight vessels at as low a temperature as possible. *Chamaecyparis obtusa* seeds should be stored in a temperature lower than 10° C. at the highest. No artificial drying of seeds is necessary previous to storing.

The best place for storing seeds is a cellar so made that the temperature is uniform, for which purpose in Tokyo it is necessary to dig 8-10 metres below the surface. The so-called "wind holes" where the people store silk worm eggs found in the mountains would serve well for storing of tree seeds.

855 - **The Genus *Juniperus* and Its Commercial Importance.** — DELLINGER, A. Royal Botanic Garden Kew, *Bulletin of Miscellaneous Information*, No. 1, pp. 1-10, London, 1916.

The genus *Juniperus* includes many species of trees and shrubs widely distributed in the northern hemisphere and occurring south of the Equator in the mountains of Eastern Tropical Africa. They are found throughout Europe, in Asia Minor, Asia from the Himalayas northwards almost to the limit of shrub life, North America, the West Indies, Northern Africa, East Africa, the Canary Islands and the Azores. They are often of slow growth, and it is doubtful whether any species planted under forest conditions in the British Isles would prove a financial success. In many instances the wood is red or yellow in colour and fragrant. It is sometimes used for building purposes and for cabinets, but its most important use is for the casings of lead pencils, no other kind of wood having been found so suitable for this purpose as the better grades of juniper. When too small or knotty for other uses, it forms very serviceable fences. Oil, used for perfumery etc. is obtained from the wood by distillation and may also be procured from the leaves and fruits of certain species. Medicinal properties of a diuretic character are possessed by the junipers. The following species are of economic importance:

J. barbadensis Linn. (Barbados Cedar, Southern Red Cedar). It is found in the West Indies and in the Southern United States, where it often grows in swamps near coastal rivers, and under the best conditions attain a height of 50 ft. with a girth of 6 ft., its average size being 30 ft. The wood is popular for pencil making.

J. bermudiana Linn. (Bermuda Cedar, Bermuda Red Cedar). It is found in Bermuda, where it grows under a variety of conditions, both in brackish swamps and on limestone hills. Average-sized trees are 40-50 ft. high. The wood is valuable for ship-building and for furniture.

J. californica Carr. (White Cedar, Sweet berried Cedar, Californian Juniper). A bush or small tree found wild in California, Arizona etc. The wood is used for fence posts.

J. cedrus Webb. and Berth (Canary Islands Juniper, Canary Island Cedar, Sabina Tree). It is native of the Canary Islands, where it ascends the

mountains to a height of 7000-9000 ft., sometimes attaining a large size. Dr G. V. PEREZ, of Teneriffe, considers it might be planted with advantage under forest conditions for its timber.

J. chinensis Linn. (Chinese Juniper). It is quite hardy in the British Isles, and is largely grown as a decorative tree or bush. The wood is durable and useful for many purposes, but is not obtainable in quantity and is of no importance in the timber market.

J. communis Linn. (Common Juniper, Ground Cedar). Widely distributed through Europe, Northern Asia and North America. In some Continental countries it attains a height of 30-40 ft. The wood is used for fencing, for milk pails and other domestic articles, and for walking sticks. The oil is used for medicinal and for flavouring purposes. The fruits have been of commercial importance (for use in the distilleries) for a long period.

J. drupacea Labil. (Drupe-fruited Juniper, Syrian Juniper). Native of Asia Minor and Syria, where it often grows 60 ft. high. Although the timber is reputed to be of good quality the consumption is apparently quite local.

J. excelsa Bieb. (Grecian Juniper). Widely distributed from the Balkans through South-East Europe to Asia Minor and Syria. In Asia Minor attains the maximum size: 70-100 ft. height and 1 ft. in diameter of the trunk. The timber is reputed to be of good quality and has been recommended for railway sleepers.

J. formosana Hayata (Prickly Cypress). A species spread over a considerable area in China and also found in the mountains of Formosa. It was introduced in the British Isles about the middle of last century, but is rare in cultivation. The timber only appears to be used locally.

J. macrocarpa Sibth. (Large-berried Juniper). Found as a bush or a small tree throughout Southern Europe and in some parts of North Africa. The fragrant wood appears to be used, with that of *J. oxycedrus* for distillation.

J. macrospoda Boiss. (Himalayan Pencil Cedar). Widely distributed from Nepal to Afghanistan, often from 40-50 ft. high with a trunk 9-7 ft. in girth, but sometimes much larger. The wood is fragrant and moderately hard: it is used for wall plates, beams and fuel. A closely allied tree from the same region is *J. religiosa*.

J. mexicana Schiede (Rock Cedar, Juniper Cedar, Mountain Cedar, Cedar). — This species forms forests on the limestone hills of Mexico and Texas where it sometimes reaches 95 ft. high. The wood is used for general construction, fencing, sills, telegraph poles, railroad ties and fuel.

J. occidentalis Hook. — (Canadian Juniper, Californian Juniper, Western Red Cedar, Yellow Cedar). — Widely distributed in North West America from Canada to California. The wood is used for fencing as it lasts well in contact with the soil.

J. oxycedrus Linn. (Sharp Cedar, Brown-berried Juniper). Common throughout the Mediterranean region from sea level up to 5000-6000 ft., usually as a shrub but sometimes as a small tree. In Italy it occupies con-

siderable areas on sand dunes. The principal use of the wood is for distillation (= oil of cade *).

J. pachyphloea Torr. (Oak-barked Cedar, Thick-barked Cedar, Mountain Cedar, Chequer-barked Juniper). — Found wild in the dry regions of Texas, New Mexico, and Arizona.

J. phoenicea Linn. (Phoenician Juniper). — An important tree in the Mediterranean region; its timber is used for building purposes and for firewood. It varies in height from little more than a shrub to a tree of 40 ft.

J. procera Hochst (East African Juniper or Cedar). — Found wild on the mountains of East-Africa. The wood, of light weight and nearly as soft as red cedar, is a likely substitute for that of *J. virginiana* for pencil-making.

J. recurva Buch-Ham. — A tree, native of Eastern Himalaya. The wood is quite equal to the best pencil cedar, but is only used for burning as incense in the Buddhist temples. *J. squamata* from the Western Himalayas, China and Formosa is a closely allied species with very similar wood.

J. rigida Sieb. et Zucc. — A shrub or small tree native of Japan. The wood has good lasting properties and is put to many local uses.

J. sabina Linn. (Savin). — A shrub or bush distributed through Central and Southern Europe, the Caucasus, North Persia and North America. The wood is of little value except for walking sticks and firewood; from the shoots and leaves is extracted a medicinal oil (savin oil).

J. scopulorum Sarg. (Red Cedar, Rocky Mountain Red Cedar). — A small tree, native of the Rocky Mountains. The wood is useful for fencing, posts etc.

J. thurifera Linn. (Spanish Juniper, Incense Juniper). — A tree distributed through Spain, Portugal, Algeria and Morocco. The wood does not appear to be used other than locally, although it is of good appearance and possesses good lasting qualities.

J. virginiana Linn. (Cedar, Pencil Cedar, Red Cedar, Virginian Cedar). This species is very widely distributed in North America, and is the most satisfactory of the large growing junipers in the British Isles. It varies from a bush to a tree 120 ft. high with a diameter of 3 ft. A very valuable species from a commercial standpoint. Its wood is used more often than that of any other kind for the casings of lead pencils. Knotty wood, unsuitable for pencil-making, is very useful for fences, railway sleepers, etc. The shavings and dust from pencil factories is distilled for the fragrance which is used in perfumery. The shavings after distillation make an excellent substitute for coconut fibre as a plunging material for horticultural purposes, as fungi do not grow upon them.

J. Wallichiana Hook f. (Black Juniper). — A variable species in the Himalaya. The wood appears to be used locally for building purposes.

37 - The Proper Season for Application of Fertilizers to *Cryptomeria japonica* and *Chamaecyparis obtusa* and the Efficacy of the Former. MORIYASU

Extracts from the Bulletin of the Forest Experiment Station, Matsuyama, 1915, pp. 1-122.
Tokyo, 1915.

The results of trials to establish the best time for the application of the 4 principal nitrogenous manures (ammonium sulphate, Chili saltpetre, rapeseed cake, night soil), together with a sufficient amount of potash and phosphoric acid as sodium phosphate and potassium phosphate to *Cryptomeria japonica* Don. (Sugi) and *Chamaecyparis obtusa* Sieb. et Zucc. (Hinoki) seedlings grown on the loamy soil, rich in humus, of the nursery in the Forest Experiment Station lead to the following conclusions:

1) The above-mentioned manures are less efficient even though applied several times, unless they are applied at the proper season.

2) The efficacy of base manures was especially noted both for *Cryptomeria japonica* and *Chamaecyparis obtusa*; this is partly due to the fact that the manure so applied is accessible for the seedlings from the beginning and partly to the perfect mixing of the manure with the soil so that the tender rootlets of the young plants can take the nutrient in the soil; the most suitable base manure both for *Cryptomeria japonica* and *Chamaecyparis obtusa* is sulphate of ammonia, nitrate of soda, rapeseed cake, where $\frac{1}{3}$ of the entire quantity is given as base manure in a few days previous to the planting of seedlings, while the rest is given as top dressings in two times, viz., in the middle of September and early in May, next year.

3) With night soil, the best result was obtained when the entire quantity was given previous to the planting.

4) With *Cryptomeria japonica* a second good result was obtained with sulphate of ammonia, rapeseed cake, and night soil, where one half of the entire quantity was given at first as base manure while the rest was given at four times, viz., at first as base manure, beginning of June, middle of September and early in June, next year.

5) As to *Chamaecyparis obtusa*, the second good result was obtained with all manures given $\frac{1}{3}$ as base manure and $\frac{2}{3}$ as top dressings, though this lot showed a medium result with *Cryptomeria japonica*; with all the rapeseed cake given previous to planting, the most disappointing result were showed for both species of tree.

6) Methods other than those above described, proved more or less inferior; further, the action of fertilizers was more noticeable for *Cryptomeria japonica* than *Chamaecyparis obtusa* as its growth is far quicker; among the manures applied, sulphate of ammonia showed the best result for both trees, and rapeseed cake the worst; with *Cryptomeria japonica* night soil showed better results than nitrate of soda, but it was just the opposite in the case of *Chamaecyparis obtusa*.

38 - Value of Eucalyptus Wood as Fuel: Experiments in the State of San Paulo, Brazil. DE ULBOA CINTRA JAYME, in *O Eucalypto*, Year VIII, No. 10, pp. 301-305.

1 fig. San Paulo, October 1915.

In order to ascertain whether the wood of the different varieties of *Eucalyptus* possesses any industrial value as a fuel, the railway Company

of the State of San Paulo, where the above writer is chief of Rolling Stock, made trials with wood of 10-year old trees from the "Horto Florestal" at Jundiáhy, using it on engines running on the Jundiáhy-Campinas line, for comparison with the wood usually burnt by this Company. The consumption per 1000 metric tons and per kilometer was as follows :

Ordinary wood selected	13.89 cubic feet.
<i>Eucalyptus rostrata</i>	15.19 "
<i>E. tereticornis</i>	21.20 "
<i>E. longifolia</i>	15.00 "
<i>E. botryoides</i>	21.29 "
<i>E. obtusa</i>	10.28 "

Therefore the different kinds of wood tried were found to possess practically equal value, slightly higher in well selected seasoned ordinary wood, and in the wood of *Eucalyptus rostrata*. The latter and that of *tereticornis* are equal or superior to the best hard woods ; they burn with short flame and last a long time. *E. longifolia*, *E. botryoides* and *E. robusta* also yield woods which are hard, though a little less so than the above named : they are excellent for passenger trains.

1958 - **Commercial Development of Forests in British India.** — *Quinquennial Review of Forest Administration in British India for the period 1909-10 to 1913-14, to which is appended the Annual Return of Forest Statistics for the Year 1913-14*, pp. 31 (8-9) 24112 2 maps, Simla, 1913.

The quinquennial review of the Forest administration in India contains a summary of the progress that is being made in the development of the Indian forests, which cover no less than 250 000 sq. miles (1). As regards the commercial development of the forests in British India, the report shows that an encouraging advance has been made.

In recent years there has been a noticeable increase in the demand for forest products, and several industries dependent on their supply have been or are about to be started. One of the most important of these is the utilization of bamboos, savannah grasses and firwood for the manufacture of paper-pulp, and to assist the development of this industry a special expert has been employed. With the assistance of the Titaghur Paper Mills Company, Limited, trials in the manufacture of bamboo pulp have been carried out successfully on a commercial scale, and concessions for the extraction of bamboos have been granted to two firms in Burma and Bengal. The outbreak of war has delayed the commencement of manufacture but as large supplies of the raw material are available the outlook is distinctly promising. In the Punjab, a concession for the extraction of spruce and silver fir from the Kulu forests for the manufacture of wood pulp has been granted. Matters are less advanced as regards the grass pulp industry, but this is being seriously considered. In the United Provinces and Assam, enormous quantities of suitable grasses are available

(1) See *B.* May 1912, No. 807 ; *B.* Feb. 1915, No. 195.

(Ed.).

and if trials on a commercial scale are successful, an important industry may be established.

The extraction of tanning materials has received attention for some time past, particularly in the matter of obtaining a satisfactory extract from the bark of mangroves. For this purpose a factory was established several years ago at Rangoon, but owing to the want of expert supervision was not very successful. In order to test the possibility of producing extracts of good quality on a commercial scale, the services of a tanning expert have been obtained. The forests of India contain many valuable tanning materials other than mangrove bark. The possibility of utilizing these will be examined by the expert, and his appointment may result in the establishment of a new and important industry.

During recent years much has been done to stimulate the local manufacture of matches; tests with numerous Indian woods have been carried out and a report regarding their suitability and the prospects of this industry has been issued. Several match factories on modern lines have been established, and if a sufficient supply of match woods of good quality can be assured, there is no reason why the industry should not grow rapidly. The regular and cheap supply of suitable wood is, however, a real difficulty, and the establishment of special plantations is a matter deserving the attention of local Governments.

The tea-box industry has received special attention in Assam where it absorbs a considerable portion of the output of the forests, and has steadily grown, especially in the Assam Valley. The Local Administration has fostered the industry by remissions of royalty on tea box wood, by devising measures for the protection of timbers used for tea boxes, and by forming experimental plantations of «simal» (1).

Large quantities of sleepers have always been obtained by the Indian railways from the forests in India, but as the supply of first class sleeper woods such as «sâl» (2) and deodar is limited, experiments in the antiseptic treatment of less durable timbers have been in progress for some years past. The Indian forests contain many timbers which, so far as structural qualities are concerned, are at least the equal of imported sleeper woods, and these, if treated antiseptically, should go far to meet the demands of the Indian railways. The best and most economical method of treatment has not yet been determined, but experiments are being carried out. Arrangements, however, have already been made with the Railway Board for the delivery of a large number of treated «chir» pine (3) sleepers from the forests of the United Provinces while a similar supply of «guriun» (4) sleepers from the Andamans is under consideration.

Another important forest industry in which, under departmental

(1) *Bombax malabaricum* DC. (BRANDIS, D. *Indian Trees*, p. 7, London 1897)

(2) *Phoraeu robusta* Gaertn. (*Ibid.*)

(3) *Pinus longifolia* Rox. b. (*Ibid.*)

(4) «Guriun», *Dipterocarpus turbinatus* Gaertn. (*Ibid.*)

management, marked progress has been made, is the manufacture of rosin and turpentine from crude resin obtained by tapping pine trees in the Indian and malayan forests. In the Punjab and the United Provinces, new distilleries have been erected and in 1913-14 these turned out 27 420 maunds of rosin and 58 803 gallons of turpentine compared with 6 584 maunds of rosin and 14 603 gallons of turpentine ten years earlier. The Indian demand for these products, which are largely used in the manufacture of paper, paints and varnishes, is considerable, and the local output has not yet fully affected imports from other countries. In the Punjab, a modern plant has been erected near Lahore and a large increase in the output is also expected in the United Provinces. It is not too much to expect that a considerable portion of the Indian demand for rosin and turpentine will soon be met by the Department.

This account of the improved methods of extraction now adopted and of the new industries which have been started, is sufficient evidence that the officers of the Forest Department are fully alive to the importance of the commercial development of the Indian forests and that they now recognise that efforts to secure commercial success are as much a part of their duties as the scientific management of the forest property entrusted to their care.

LIVE STOCK AND BREEDING.

1959. "Emphysareol" (*Emphysarcolum siccum* Foth), a new Vaccine for the Treatment of Symptomatic Anthrax. — FOTH H., in *Berliner Tierärztliche Wochenschrift*, 32nd Year, No. 11, pp. 121-123. — Berlin, March 16, 1916.

The Author, in 1911, published results of experiments carried out under the auspices of the Prussian Ministry of Agriculture with the object of obtaining an effective vaccine against symptomatic anthrax. He had prepared a specific anti-infection serum for cattle, and a vaccine (*Emphysarcolum siccum*) prepared from pure cultures of the anthrax bacillus.

The experiments have since been continued. The preparations of the serum, however, was given up on account of the expense, though it gave good results with simultaneous injections. On the other hand, excellent results were secured with the vaccine prepared from pure cultures of the anthrax bacillus, which the Author calls "Emphysareol". It is a yellowish-white powder composed of : albumens soluble in water, dead bacilli of symptomatic anthrax, living spores of anthrax, and products of metabolism of the spores. This vaccine is prepared with 2 types of spores which differ in virulence. Type A is very virulent and rich in spores, and requires to be toned down ; type F, less virulent, almost free from spores, does not require to be weakened.

The preparation of the vaccine is perfectly easy for anyone with bacteriological experience.

The vaccine is tested on guinea-pigs, and afterwards injected into the

injection subcutaneously, using half of the dose required to kill a guinea pig weighing 9 oz.

The vaccine which the Ministry recommends has been on the market since 1915. All veterinary surgeons who have tested it have reported favourably upon it.

Test with Salvarsan in the Treatment of Glanders; its Influence on the Formation of Antibodies in the Blood of Horses. WIESSNER and LANGER, in *Zeitschrift für Tierärztliche Wissenschaft*, 24th Year, No. 12, pp. 121-124, Hanover, April 1916.

The Authors tested the efficacy of salvarsan and neosalvarsan in the treatment of glanders in 8 horses. In order to obviate risk of failure due to an advanced stage of the disease, they made use of animals having no apparent symptom of glanders, but the examination of whose blood suggested its presence. With all the subjects, the blood was examined both before and after the injection of salvarsan so as to ascertain at the same time the influence of the drug on the formation of antibodies in the blood. A few weeks afterwards the horses were killed and the pathological changes in their organs were examined.

The post-mortem showed that 2 of them were quite healthy, while in the others were fresh pathological changes and in the remaining animal these changes had reached an advanced stage. As the 2 healthy horses showed no pathological change, not even one subsequently cured, it is held that they never suffered from glanders, thus precluding any curative action of the preparation tested. On the other 5 horses salvarsan had no effect, as evidenced by the fact that after the treatment pathological changes occurred. In one case alone the disease was stopped after the injection, but not necessarily by the injection itself, as it is known that the change may lapse into a latent stage without treatment of the animals. The general conclusion is that it is impossible to cure glanders with salvarsan or neosalvarsan.

The examination of the blood before and after injection of the drug, with a view to ascertaining the influence of salvarsan on the formation of antibodies, is still doubtful in its result. By employing the agglutination method, however, there was observed a reduction of the antibodies in all the sick horses shortly after the injection, and some time later, an increase. Probably, therefore, the injection of salvarsan or neosalvarsan allows of detecting whether or not a horse is suffering from glanders.

1. The Virulence of the Blood of Animals Suffering from Epizootic Foot-and-Mouth Disease. — COSCO GRESSENIER and AGUIZZI ANGELI, in *Le Chimica farmacia*, Vol. XXXIX, No. 7, pp. 193-195. Milan, April 15, 1916.

The General Direction of Public Health in Italy has instituted a series of experimental investigations into epizootic foot-and-mouth disease, by a number of investigators. The above article contains a summary of the experiments on the prophylaxis of the disease conducted at the "R. Caserma" (Royal Farm) of Poggio ai Caiani (Florence) comprised in this group of investigations. Up to now 116 cattle have been subjected to test with the following results:

1) The blood of animals infected with foot-and-mouth disease is virulent during the entire febrile stage. The virulence is of high degree not inferior to that of the products of the characteristic eruptions of the disease.

2) The red corpuscles and the serum of the blood of the infected animals, inoculated separately into cattle, are also virulent.

3) The defibrinised blood of these animals, kept in a refrigerator retains its virulence for a long time (more than one month). This virulence of the red corpuscles lasted longer than that of the blood serum.

4) The red corpuscles, repeatedly washed in large quantities of sterilised physiological solution, in order to remove any trace of serum, and afterwards inoculated into the cattle hypodermically, even in a dose of 1 cc., communicated the infection. Injection of the same dose of serum is also capable of communicating foot-and-mouth disease to cattle.

5) Inoculation of the infected blood into cattle in series enhances its virulence.

6) No onset of the disease appears to follow infection of the cattle through the ordinary channel (the mouth) when the washed red corpuscles are used as the infecting material.

The red corpuscles, which therefore possess a virulence lasting some time, provide: 1) a highly pure infective material which can be kept more than one month; 2) a homogeneous cellular mass containing the virus in the pure state, which may really be regarded as a culture of the pathogenic agent, and can be subjected to certain operations used in preparing vaccines, which are very difficult or impossible with the highly impure products of the local eruptions and their filtrates.

692 - **Experimental Studies of Castration: its Effects on Oxygen Exchange of the Tissues.** — AGNOLETTI GIUSEPPE, in *La Clinica veterinaria*, Year XXXIX, No. 1, pp. 195-199, Milan, April 15, 1916.

The results of these investigations, carried out at the Laboratory for Experimental Physiology in the Higher Veterinary School of Milan, Italy may be summarised as follows:

The tissues of young castrated animals produce a quantity of carbonic acid markedly below that of entire animals; the former also consumed less oxygen than the latter. The difference was more pronounced in the liver than in the muscles, that being the organ which was most affected by the castration, and which showed the largest reduction in elimination of carbonic acid gas and absorption of oxygen. It may be assumed that the tendency to fatten in castrated animals is related to this large reduction in the oxygen exchange of the liver.

693 - **Investigations into Nutritional Deficiency** (1). — I. WEILL E., MOURIQUAND G. and MICHEL P., in *Comptes Rendus de Séances de la Société de Biologie*, Vol. LXXIX, No. 3, pp. 189-193. — II. WEILL E. and MOURIQUAND G., *Ibid.*, pp. 194-199. Paris, March 1, 1916.

I. — In a previous series of notes Messrs. WEILL and MOURIQUAND demonstrated that the sterilisation of grain (barley) caused nutritional de-

(1) See *B. April*, 1915, No. 475.

deficiency troubles in pigeons identical with those produced by husking. In order to ascertain whether the sterilisation of meat can produce derangements of a similar kind in mammals, experiments were carried out with rats fed exclusively on meat, raw and fresh, frozen, recently salted, cooked, freshly sterilised and old. The results prove that it is possible, with cats fed exclusively on sterilised meat, to produce nervous disorders (paraplegia, convulsive or cerebellar) closely approaching, if not identical with, those occasioned in pigeons by the sterilisation or husking of cereals. The ageing of the sterilised meat appears to hasten the moment of onset of the disorders. The whole is entirely consistent with the view that sterilisation deprives meat, just as it deprives grain, of the "ferment substance" necessary for nutrition, especially of the nervous system.

II. — After having ascertained that the localisation of the "ferment substances" in grains is chiefly cuticular, the question arose whether raw husked cereals did not themselves, though in lesser quantities (incapable of averting nutrition troubles for any length of time) contain these same substances or a combination of "living" substances able to retard the appearance of the pathological symptoms. In order to solve this question a comparison was made on 4 lots of pigeons between the effect of feeding exclusively with a raw husked cereal (barley or rice) and that of exclusive feeding with the same husked cereal sterilised at 120° C. for 1½ hours. The results showed that sterilisation deprived the husked grain of a residue of "ferment substances" which it had not been possible to detect in the previous investigations.

These facts have a practical application. The flour of husked cereals gives rise to nutritional deficiency trouble in the chick and the adult (senary and beri-beri). Its sterilisation, by removing the little amount of "ferment substance" which remains, seems likely to increase the danger attending its consumption. As regards the sterilisation of milk, especially when intended for children, the writer does not prohibit it, but advises that it should not be excessively prolonged, or else that a small quantity of orange juice be added to the sterilised milk.

(**Trade in Concentrated Foods for Livestock in Uruguay.** From a Communication to the "Ministerio de Industrias, Oficina de Estadística y Producciones", Montevideo, 1915.)

As a result of the enquiry of the International Institute of Agriculture into the trade in concentrated foods for livestock in different countries, the "Inspección nacional de ganadería y agricultura" (Livestock and Agriculture Inspection Office) and the "Inspección de policía sanitaria animal" (Health Office for Livestock) in Uruguay gathered the data existing in relation to that country.

Production. That of linseed cakes is sufficiently extensive, owing to the amount of flax-growing for seed; the production may be estimated at 608 tons for the period 1901-1913. The production of earth nut and

(1) See: INTERNATIONAL INSTITUTE OF AGRICULTURE, BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *The International Trade in Foodstuffs*, No. 1, and 2 (1908, 1915 and 1916). (Ed.)

rape cakes (406 tons for the same period) is less developed. Beetroot pulp, produced in the sugar mill in the department of Maldonado is not used by that mill for its draught oxen; the molasses are sold for the manufacture of alcohol. Furthermore, the by-products of two big breweries in Montevideo are used on the spot, being given wet to cows and dry to horses. One of the principal products of Uruguay, as a concentrated food for livestock, is meat meal, of which Liebig's Meat Extract Company at Fray Bentos turned out, from 1904-1914, the quantities indicated in Table I.

TABLE I. — *Quantities of Meat Meal produced by Liebig's Meat Extract Company from 1904 to 1914.*

Seasons	Tons	Seasons	Tons
1904-1905	3 324.4	1910-1911	1 478.2
1905-1906	4 238.6	1911-1912	1 929.4
1906-1907	2 168.2	1912-1913	1 531.
1907-1908	2 220.9	1913-1914	1 115.1
1908-1909	2 076.7		
1909-1910	2 682.7	Total	23 092.7

The following is the chemical composition of Liebig's meat meal: Water, 11.70 %, Ammoniacal Nitrogen 13.98 %, Fats, 12.25 %, Mineral substances, 2.68 %. On the other hand, the "Frigorifico Montevideo" from its foundation till 1904, produced 1016 tons of meat meal.

Exportation. Uruguay exports concentrated food for cattle and live stock generally, as shown by the following particulars:

TABLE II. — *Export of Bran and Milling Offals from Uruguay.*

Years	Bran	Offals
1901-05	3 160 tons	970 tons
1906-09	2 600	2 105
1910	1 710	1 470
1911	903	1 000
1912	9 125	3 153

The meat meal referred to above is almost wholly exported to the following countries: Germany, Belgium, United Kingdom, United States.

Consumption. Owing to the extensive character of livestock production, due particularly to the natural grass-lands, and also in part to forage cultivation, concentrated feeds are not consumed in Uruguay in any appreciable quantity, except for stabled animals and partly in the dairy industry (in which cases brewers' residues, linseed oil and maize cakes are used to fatten up show animals, or, still more frequently, bran and milling offals, especially if the pasturage in winter is not sufficient for the dairy cattle). Nevertheless, according to the investigations of Prof. SCHROEDER (1)

(1) See: *Bibliography*, in *The International Trade in Feeding Stuffs* quoted above.

TABLE III. — *Exportation of Oil Cakes from Uruguay*

Years	Linseed	Cotton	Ground-nut	Rape
1905	44,100	—	60 tons	10 tons
1906	200	13,100	18	—
1907	203	5	—	—
1908	507	—	—	—
1909	430	—	—	—

it will be possible in Uruguay to make use of numerous agricultural and industrial bye products (rice flour, brewers' and maize waste, linseed, rape and ground-nut cakes), as well as dried blood and fish meal; always, however with regard to the price of other cattle foods on the market.

Prices. The following are the prices of the 2 principal products:

Linseed oil cakes: £6. 14s. - £7. 7s. per ton, at par

Meat flour: £12. 2s. per ton, at par

4. — *Horse-breeding in Italy, in 1914; Strength of Studs.* — *Relazione and Memoria di Agricoltura, Industria e Commercio*, Year XV, Parts 11 and 12, pp. 11-12. Rome, March 11 and 18, 1916.

On the 1st January 1914, the numerical strength of the various Studs comprised 861 breeding sires, divided as follows:

Thoroughbreds	English	563	100%
	Oriental	10	1.2%
	Anglo-Oriental	88	10.2%
Halfbreeds		134	15.6%
Quarterbreeds		212	24.6%
Trotters		45	5.2%
Heavy draught horses		147	17.0%
Total		861	100.0%

As regards types, there were: 256 saddle stallions, 142 saddle and light draught stallions, 45 trotters and 148 heavy draught stallions.

In the course of the year, owing to death or supercession, there was a reduction of 42 stallions. In order to replace losses, and gradually increase the number of stallions, in accordance with the Law of the 6th July 1912, No. 832, thoroughbred and halfbred stud stallions were bought within the Kingdom. In February 1914, nevertheless, there were imported from Egypt (at the total price of £2,216. 18s. or an average of roughly 200. 10s. 11 oriental stallions, the proceedings for purchase of which were in progress at the end of 1913).

For the stallions purchased in the Kingdom the following were the prices paid:

	Total price	Average price
7 English thoroughbreds for crossing	£ 2,797 10 s.	£ 181 10 s.
5 Pure oriental and Anglo-oriental thoroughbreds	785 10 s.	157
2 French trotters	793 10 s.	117
1 American trotter	—	150
9 Heavy draught stallions	1,627	180 10 s.
36 Crossbreds (halfbreds and quarterbreds)	5,408 10 s.	150
4 Hauls from the breeding depot of Latham	349	—

On the 31st December 1914, the Studs comprised 924 stallions, divided as follows:

Thoroughbred	English	95	10 25
	Oriental	114	18 38
	Anglo-oriental	57	—
Halfbreds	139	—	—
Quarterbreds	329	55.00	—
Trotters	42	—	—
Heavy draught	181	16.31	—
Total		924	100.00

As regards the mares served by the State stallions in 1914, they were divided as shown by the appended Table

Classification of Mares served.

Descriptions of Stallion	Number		Average number of mares per stallion of each description	Number of mares per stallion General average
	of serving stallions	of mares served		
English thoroughbreds	90	3,841	42.67	50.08
Oriental thoroughbreds	113	4,710	41.68	
Anglo-oriental thoroughbreds	54	2,128	39.10	
Halfbreds quarterbreds	444	23,252	52.36	
Trotters	48	2,582	53.70	
Heavy draught horses	146	8,314	56.94	—
Totals	895	41,827	—	

The stud expenses for 1914 show the following averages per stallion

	£	s.	d.
General expenses	13.	3.	5.
Staff	50.	10.	8.
Foodster (Annual expenditure	30.	12.	0.
Average cost of daily ration	0.	2.	0.

666 — Requirements for Advanced Registry of Cattle Breeds in the United States. HOARDS' DAIRYMAN, Vol. LI, No. 4, p. 145. Fort Atkinson, Wis., February 18, 1916.

The appended Table gives the requirements for admission to the Advanced Registry of the 5 principal breeds: Ayrshire, Brown Swiss, Guernsey, Holstein-Frisian and Jersey.

Advanced Registry Acquisitions

	Ayrshire			Brown Swiss			Guernsey			Holstein			Jersey		
	Milk in 305 days Lbs.	Fat in 305 days Lbs.		Milk in 305 days Lbs.	Fat in 305 days Lbs.		Milk in 305 days Lbs.	Fat in 305 days Lbs.		Milk in 305 days Lbs.	Fat in 305 days Lbs.		Milk in 305 days Lbs.	Fat in 305 days Lbs.	
Two years	6 000	214.3		6 000	222.0		250.5	250.5	7.2	250.5	12.0		250.5	11.8	
Three years	6 500	256.0		6 420	238.4		287.0	287.0	8.8	287.0	12.0		287.0	11.8	
Four years	7 500	279.0		7 286	271.3		323.5	323.5	10.4	323.5	12.0		323.5	11.8	
Five years	8 500	322.0		8 143	304.1		360.0	360.0	12.0	360.0	12.0		360.0	11.8	
Six years	8 500	322.0		8 000	337.0		360.0	360.0	12.0	360.0	12.0		360.0	11.8	
<i>Required Average Daily Intakes</i>															
From 2 to 3 yrs . . .	4.37	0.40		—	—		—	—	—	—	—		—	—	
From 3 to 3 yrs . . .	2.74	1.2		—	—		—	—	—	—	—		—	—	
From 3 to 4 yrs . . .	—	—		—	—		—	—	—	—	—		—	—	
From 4 to 5 yrs . . .	—	—		—	—		—	—	—	—	—		—	—	
From 5 to 6 yrs . . .	—	—		—	—		—	—	—	—	—		—	—	
From 6 to 7 yrs . . .	—	—		—	—		—	—	—	—	—		—	—	

The seven-day tests must constantly be supervised by an inspector usually appointed by the State Agricultural College, and the year tests must be authenticated by one or two days inspection each month by a similar official. All associations try to guard their registers from trickery and fraud, and have certain rules that must be complied with.

Official tests are those which are under constant supervision; and semi-official or authenticated tests are those which are based upon official supervision for one or two days each month. All cows are subject to re-culling when their production has been properly authenticated according to the rules, and they reach the required amount for their attained age.

The requirements for the entry of bulls in the Advanced Register are:
Ayrshire: All bulls having 4 daughters in the Advanced Registry from different dams, or scaling 80 points and having 2 daughters in the Registry from different dams.

Brown Swiss: All bulls having 4 daughters in the Register of Production (advanced Registry) from different dams.

Guernsey: All bulls having 2 daughters in the Advanced Registry.

Holstein: All bulls having 4 daughters in the Advanced Registry.

Jersey: All bulls after 3 of their daughters from as many different dams have been entered in the Register of Merit (Advanced Register) or a year's authenticated fat or butter record.

667. **Regulations adopted by the Argentine Rural Society for Registering Milk Records of Dairy Cows.** - *Anales de la Sociedad Rural Argentina*, Year LI, No. 1, pp. 7-9; Buenos-Ayres, January-February 1916.

The "Sociedad Rural Argentina" has adopted the following Regulations for the introduction of Registers of the milk records of dairy cows.

CHAPTER I. -- (1) The Argentine Rural Society shall, in accordance with the resolutions of its directing Committee, prepare Registers of the milk records of those cows which, according to the present regulations, are recognised as suitable for forming milking strains.

(2) After testing, the milk productivity of imported cows or their offspring, mongrels, crosses and sub-species reared in the country, shall be entered in this Register, provided they fulfil the conditions laid down by the Regulations.

(3) Pure breed cows with a pedigree will be entered in the pedigree Registers for pure bred animals, prepared by the Society in conformity with the Pedigree Regulations; the milk production will be ascertained and recorded in the margin of the sheet.

(4) This Register will be placed in the charge of the "Comisión de Fomento de la Industria Lechera" (Commission for promoting the Dairy Industry), which will comply with the provisions of articles 5 *et seq.* of the general Regulation for Pedigree Registers, and those of Chapter I, with the exception of article 9.

Under this article, and the corresponding ones cited from the general Regulations for Pedigree Registers, 4 members of the Commission form a quorum.

CHAPTER II. (5) Applications for registration must be made to the

direction of the Argentine Rural Society, after paying the fees to the "Comisión de Fomento".

(6) Should registration not be granted, the manager of the Society will notify the applicant, and the amount paid in for fees will be returned.

(7) Applications for productivity tests must be made to the manager of the Argentine Rural Society within 30 days after calving, and such tests will be made within 30 days from the application.

(8) The productivity tests may be applied once or for several times for the same cow, on payment of the charge each time, and the results will be entered on the corresponding sheet of the register.

(9) Every heifer calf of a cow which has been tested, accepted and entered in the Register must be declared in the 6th month after birth and marked on the right ear, or branded on the skin, with its progressive number in the private Register of the breeder; it will be entered in the Register of the Argentine Rural Society when, after calving, the owner deems it to possess the qualifications required. Any bull calf of a cow tested, accepted and entered in the productivity Register shall be entered as belonging to a milk-producing family, provided he has been declared and marked on the right ear or branded on the skin, in the 6th month after birth.

(10) Any buyer of a tested cow must notify the Argentine Rural Society of the purchase and request transfer into his name.

(11) The Society will issue certificates of sale of the cows entered in the Productivity Register, specifying the productivity shown during the test period. It shall also issue certificates for heifers, specifying the milk records of the dams, grand-dams, etc., provided the births have been declared within the time fixed and the animals have a tattooed mark in the right ear, or a brand on the skin, according to the breed, with the private Register number.

(12) Any tested cow admitted to the Productivity Register will bear, tattooed on the left ear, the number assigned to it and the mark of the Argentine Rural Society.

(13) Any person committing, or endeavouring to commit, fraud in relation to registration or authorised copies, or in any way impairing the truth and accuracy of the Registers, shall be deprived by the directing Committee of the rights granted by such Registers, and disqualified for benefiting from any connection with them.

(14) To the members of the Argentine Rural Society the tariffs of charges is as follows:

	Pesos national currency
For testing and registering a cow	5
For registration of a bull	5
For a certificate of sale and copy of register of a tested cow	5
For a certificate of sale and copy of register of an untested heifer or bull	5

To non-members these charges are doubled.

(15) Applicants for test must lodge the inspector, and, if the charge does not cover the travelling expenses, must pay the difference.

(16) Milking will take place twice a day, at intervals of 12 hours in the presence of the inspector.

Class A. — The dairy breeds Holstein, Dutch, Flemish, Freiburg, and other similar ones, pure or mongrel, giving the biggest quantities of milk, must show a minimum yield of 4.4 lbs. of butyrometric fat produced during the 5 days of test, in the case of cows having 5 permanent teeth; 4.84 lb. of butyrometric fat produced in the 5 days of tests, for dairy cows having complete dentition (see Appendix).

Class B. — The dairy breeds Shorthorn (Durham), Lincolnshire Red, Shorthorn, Red Polled, Hereford, Aberdeen Angus and other similar ones, pure or mongrel (of average productivity) must give a minimum yield of 3.95 lbs. of butyrometric fat produced during the 5 days of tests for cows having 6 permanent teeth; 4.4 lbs. of butyrometric fat produced in the 5 days of tests for cows having a complete dentition (see Appendix).

Class C. — The dairy breeds Jersey, Kerry and other similar ones, pure or mongrel (with minimum production) shall show a minimum production of 3.52 lbs. of butyrometric fat produced during the 5 days of test for cows with 6 permanent teeth; 4.18 lbs. of butyrometric fat produced during the 5 days of test, for cows having their complete dentition (see Appendix).

APPENDIX. — *Approximate equivalents of the daily production of milk and butter-fat required for admission to the Test Register.*

Class A: 4.4 lbs. of butyrometric fat during the 5 days of test, with 2.8 % of butter-fat are equivalent to a production of 25.7 pints of milk per day for cows having 6 permanent teeth; 4.84 lbs. of butyrometric fat in 5 days of test, with 8 % of butter-fat are equivalent to 28.16 pints of milk per day, for cows with complete dentition.

Class B: 3.96 lbs. of butyrometric fat during the 5 days of test, with 3.2 % of butter-fat, is equivalent to a production of 20.2 pints of milk per day for cows with 6 permanent teeth; 4.4 lbs. of butyrometric fat in the 5 days of test, with 3.2 % of butter-fat are equivalent to a production of 22.0 pints of milk per day for cows with complete dentition.

Class C: 3.52 lbs. of butyrometric fat in the 5 days of test, with 4 % of butter-fat, is equivalent to a production of 14.4 pints of milk per day for cows with 6 permanent teeth; 4.18 lbs. of butyrometric fat with 4 % of butter-fat, is equivalent to 16.7 pints of milk per day for cows with complete dentition.

6028 — **The Fleece of Russian Coarse-woolled Sheep.** — KOVALYUSKIY S. N., in *Сельское хозяйство и Лесоводство* (Agriculture and Sylviculture), Year LXXII, Vol. CCL, pp. 20-67. Petrograd, January 1916.

The rapid decline of merino breeding in Russia, the advent of "artificial wool" on the market (obtained by teasing or spreading the fibres of woollen rags), and finally the remarkable stability of the industry of coarse-woolled sheep rearing on peasant farms, suggested a series of experiments with a view to determining the technical and economic value of the fleece from coarse-woolled sheep, especially as, in the view of M. FEDEROV, Professor in the Higher Technical Institute of Moscow, investigations of this kind on local breeds have been entirely wanting up to the present, though they

of great interest, not only for sheep rearing but also for the wool industry.

The investigations of the wool of local breeds in the province of Vologda (Southern Russia) and other regions, sought to determine: (1) the yield of pure wool; (2) the proportion of coarse wool (containing medullary substance) and the fine wool (without medullary substance); (3) the length and diameter of these wools; (4) their strength and extensibility.

The conclusions arrived at may be summed up as follows:

1) The fleece of coarse-woolled sheep is made up of 2 kinds of wool, *coarse* and *fine*. The latter can, in point of technical quality, replace merino wool in many woven fabrics, being stronger than the latter. The table showing the results obtained by this and also other experimenters with regard to the strength of different wools, brings out clearly the fact that, while for merino wool the breaking load does not exceed 0.000 to 0.001 grams per square micron, for wools of different coarse-fleece breeds this load varies between 0.014 and 0.020 gr., and is only below breaking strain of merino wools in 2 or 3 cases. Owing to their great strength, these wools will be valuable for woven fabrics requiring great stretching powers, for instance socks and stockings.

With regard to the economic side of the question, a comparison of the respective prices of merino wools and those of coarse-woolled sheep shows that the latter, which averages 30% of fine wool, does not fetch a price proportionate to its value, fetching only a little more than half that of merino wool. If the importance of the fine wool in sheep with coarse fleece were more appreciated, and manufacturers separated the fine from the coarse, they could then pay one and a half times to twice as much for the coarse wool as they do at present, and be useful both to users and growers. At the same time, the exact valuation of the wool from coarse-fleeced animals according to its contents of fine wool and the quality of this latter, would furnish valuable indications for improvements in sheep breeding.

2) The investigations of the wool of Karakul sheep did not bear out either the views held in practice as to the coarseness of wool of this breed as compared with other coarse-woolled breeds nor the oft-given advice that breeding rams should be selected on the basis of coarseness of wool, for was any relationship observed between the quantity of fine wool and the quality of the fleece in coarse-woolled breeds.

3) The first requisite for the improvement of sheep rearing and of wool production is the creation of a special central institution for the study of the subject.

4) According to the writer, who studied wools from the morphological point of view and compared the results of his investigations with those obtained by M. MASALIK BASIT, in reference to the wool of Balkan sheep, the coarse wool (*i. e.* that containing the medullary substance) of coarse-fleeced sheep is polymorphous as regards the form and arrangement of the small epidermic scales. As regards the determination of the breed from these two characters, it will only be possible after an attentive study of the variations peculiar to a given breed.

669] — **Experimental Rearing of the Silkworm in "Tilimbars", in Southern Italy.**
BUCCI PIETRO, in *La Stazione sperimentale agricola italiana*, Vol. LXIX, Part 2, pp. 1-5,
Modena, 1916.

Mention is made of the first descriptions of Persian "tilimbars" in previous attempts at rearing in "tilimbars" made in Southern Italy chiefly by Prof. LEONARDI at Portici (Naples). After the Law in favour of silkworm rearing was passed in 1912, the following years witnessed a large increase in the number of trials through the initiative of the Ministry of Agriculture. Sometimes the results were inadequate owing to mistakes in construction or position of the "tilimbars", so that they did not form a sufficient shelter and exposed the silkworms to sudden changes of temperature. In most cases, however, the results were satisfactory. Thus, in the rearing work undertaken by the Agricultural Travelling Lecturer Institute of Benevento with the native yellow race, the "tilimbars" proved effective as regards yield, and furnished silk with properties somewhat better than those possessed by the same worm reared for purposes of comparison in the nurseries. In any case, "tilimbar" rearing gives promise of a large saving in installation and labour expenses.

A detailed description follows of the rearings undertaken on a property of the Royal Oenological School of Avellino, with the yellow "Ascoli-Clementi" breed. The costs of construction of a "tilimbar" 13 × 26 ft. amounted to £ 3. 2 s. 8 d. that of the Friuli "pezzone" (flame) placed therein to 9s. 6½ d. The weight of eggs bred was 1.05 oz. and the total cost £ 7. 6s. 3½ d. (as against £ 11. 0s. 3 d. for breeding in the nursery on hurdles), including a depreciation for the "tilimbar" etc. rated at £ 2. 7s. 6 d. The most important results are appended:

	"Tilimbar" rearing	Nursery rearing
Good cocoons, per ounce of eggs lbs.	147.7	65
Bad and double cocoons per cent.	6	7
Number of cocoons per lb.	218	520
Cost of production of 1 lb. of cocoons pence	10.6	14.16

In order to study the effects which rearing in the "tilimbar" produces on the quality of the silk, an examination was made in the Experimental Laboratory at Milan, of the cocoons obtained in the "tilimbar" and those obtained in the nursery. The following were the principal results:

Cocoons obtained	Weight of cocoons reeled — grms.	Silk produced, absolute weight — grms.	Waste per cent. of silk —	Weight of 450 metres in "denari" (1 denaro = 0.05 grms.) — denari	Average elasticity — mm.	Breaking strain — grms.	Loss in gmo. removed — %
In the "tilimbar"	206	80.116	25.75	14.41	224.88	101.32	24.0
In the nursery	306	83.855	26.33	14.10	225.76	91.80	25.0

(1) See *B* January 1914, No. 245

Conclusion. — The "tilimbar" furnishes a possible solution of the problem of rational silkworm rearing where suitable premises are wanting, as it is clearly proved that on this method cocoons of good quality, even of fairly delicate breeds, such as the native yellow, can be obtained at cost prices below the selling price, even in unfavourable years.

FARM ENGINEERING.

670 — **Official Trials of Tillage Machines in France.** SAGNIER, HENRY in *Journal d'Agriculture Pratique*, Year 80, New Series, Vol. 20, No. 8, pp. 141-146, Paris, April 20, 1916.

The new series of trials of tillage machines organized by the French Ministry of Agriculture took place at Gournay-sur-Marne (Seine et Oise) between April 4 and 13 of this year.

These trials, like those of Grigny and of Chevry Cossigny of last autumn, are carefully controlled, that is, besides the public trials, other trials are carried on with the same machines under the direction of M. RINDELMANN, director of the Agricultural Machinery Experiment Station, for days and weeks in order to test the work done, the consumption of fuel, the power exerted at the draw-bar etc.

Twenty-two machines were entered for these trials, but owing chiefly to difficulties of transport only about a dozen were presented. They, however, showed what progress has been recently achieved in this line. The following are some of the machines that were tried:

1) Two MOGUL agricultural tractors, one 25 nominal HP, weighing 2460 lbs., and one 16 HP weighing 5440 lbs. The smaller one is remarkable for its adaptability, having been able to haul a pulverizer over ploughed land without in any way injuring the work done.

2) An AVERY 35 HP, tractor weighing 11 550 lbs. which worked very regularly.

3) A 20 brake HP, 4 cylinder EMERSON tractor weighing only 5440 lbs. It showed great regularity of work and adaptability.

4) A MISSVALLEY tractor of careful construction.

5) TOURAND DERGHESSÈS rotary digger provided with powerful tines mounted on parallel shafts.

6) TOURAND DERGHESSÈS motor plough.

7) DUBOIS plough joined to a 4 wheeled two cylinder 20 HP, vertical motor.

Together with the above, a strong tipping motor Carry of the "Sterling" type was presented.

71 — **A Cooperative Society for Machine Ploughing.** MAX RINGELMANN in *Journal d'Agriculture Pratique*, Year 80, New Series, Vol. 20, No. 8, pp. 145, Paris, April 20, 1916.

A cooperative society for machine ploughing was formed in January of this year at Mossais near Confolens (Vienne, France). It is composed of eight members whose farms extend over 578 acres. The fields are

situated close to each other and near the farms, they are from 10 to 62 acres each and on flat or slightly undulating ground, thus being in all respects favourably situated for ploughing by machines. About one third of the acreage is heavy clay, the rest is loam. On the former three pairs of oxen cannot plough more than half an acre a day.

The Cooperative Society has chosen a 25 h. p. Case tractor and a three-furrow Sattley plough. The tractor cost about £525 and the plough £500; the expense is borne by the eight members in proportion to the areas to be ploughed.

The Statutes of the Society are copied from the model drawn up by the Ministry of Agriculture.

The yearly subscription of each member is 16 shillings and the supplementary contributions may not exceed £4. The expenses of all kinds will be divided every month *pro rata* of the acreage ploughed during the time.

The order of succession in which the members are to use the outfit is settled by drawing lots and when the machines have been round once the order will be reversed. A preference, however, is given to the heavier land which is to be ploughed during fine weather.

The society has been granted a subvention of about £160 by the Ministry of Agriculture.

672 - **Quickly-detachable Plough Shares.** -- *Farm Implement News*, Vol. XXXVII, No. 6, pp. 36, Chicago, February 10, 1916

The new Emerson Brantingham ploughs are fitted with a quickly detachable share which can be removed, it is claimed, in three seconds and replaced in five, without requiring the use of a single tool, not even a wrench.



Quickly-detachable Plough share.

fig. 1. shows the studs in the share, the slots in the body of the plough and the levers on the mouldboard and body which hold the share in position; fig. 2 shows the studs in the slots ready for locking and fig. 3 the share solidly locked.

273. — **Slow-speed and High-speed Motors.** RINGHEIMANN, MAX in *Journal d'Agriculture Pratique*, Year 80, Vol. 20 (New Series), Nos. 6 and 7, pp. 111, 114 and 128-31, Paris, March 23 and April 6, 1916.

In this paper a comparison is made between slow speed and high speed motors. The writer considers the latter the most advantageous, because they are less bulky; much easier to start, and less liable to the wear and tear due to shocks and vibrations which do not, as some erroneously believe, increase with the speed.

In support of his views he compares two 16 HP motors of recent construction, having the following dimensions etc.:

	Slow speed motor	High speed motor
Number of cylinders	4	4
Bore (millimeters)	205	160
Stroke (millimeters)	211	150
Number of revolutions per minute	400	1,200

In a properly managed engine there should be no shock at the end of the stroke, as this occurs only when too much play is left between the connecting rod and the crank, and between the shaft and its bearings.

There is, however, a certain shock at the moment of explosion which acts on the inner surface of the compression chamber and on the lower surface of the piston. The effect of this shock may be considerable when early ignition is exaggerated, and it occurs in all motors independently of their speed. At the moment of explosion a sudden increase of pressure is produced and is transmitted to the junction of the piston with the connecting rod and to that of the latter with the crank.

The pressure in kilograms per square centimetre (1 kg. per cm² = 14.7 lbs. per sq. inch) is easily calculated from the indicator diagrams and is, for the two machines, as follows:

	Slow speed motor	High speed motor
Maximum pressure (kilos. per sq. cm)	9	17
Total pressure on piston (kilos.)	2,472	6,720
Ratio of total pressures	1	2.72

Thus, as the sudden pressure on the connecting rod and crank is nearly four times greater in the slow motor than in the rapid one, the working surfaces in the two motors should be in the same ratio to each other, whereas they are relatively larger in the rapid motor.

The wear and tear of the parts is proportional to the number of explosions in the unit of time and is represented by the product of the above ratio (2.72) and 1 by the ratio of the number of explosions per minute.

	Slow Speed motor —	High speed motor —
Number of explosions per minute	200	600
Ratio of above numbers	0.333	1.00
Ratio of total pressures	3.81	1.00
Ratio (product of above ratios)	1.26	1.00

Thus the deterioration due to the effect of the explosions is $1\frac{1}{4}$ times greater in the slow engine than in the rapid one.

The *vis viva* (the mass of a body multiplied by the square of its velocity of the working parts, which, it is claimed produces vibrations and losses of energy, is $3\frac{1}{2}$ times higher in the slow speed engine than in the other one, inasmuch as considering only the piston and its weight as a function of its area, the following data are obtained :

	Slow speed motor —	High speed motor —
Number of revolutions per minute	400	1200
Velocity of piston in metres per second	4.05	4.80
Square of piston velocity	16.40	23.04
Area of piston (sq. centimetres)	323.6	63.6
Product of square of piston velocity by area of piston	5307.4	1495.34
Ratio	3.62	1.00

On applying the above method to the examination of the injurious effects of the vibrations of the connecting rod, it is found that they are nearly seven times greater in the slow speed motor than in the high speed one. The wear by friction is also greater in the former.

The conclusion that the writer draws is that from every point of view, including also the consumption of fuel, the slow speed is inferior to the high speed motor.

674—**New Method for the Detection of Unexploded Shells in the Field.**—BOYER, JACQUES in *La Nature*, No. 2,19, pp. 230-240, Paris, April 8, 1916.

When shells fall on very wet soil or when their fuses are defective, they often bury themselves in the ground without exploding; their presence in arable land is a source of danger, as when struck by a plough or other implement, they are liable to explode.

Owing to several fatal accidents to ploughmen, in France, due to this cause, M. CUTTON, professor of Physics at the University of Nancy, with the assistance of M. TIMY, director of the Mathieu de Dombasle school, devised an induction balance for the discovery of buried shells.

It consists of two flat coils (fig. 1) A_1 and B_1 connected in series on the same circuit and traversed by an alternating current inducing two neighbouring coils A_2 and B_2 also connected in series. In these the winding is so arranged that at any given moment the electromotive forces are respectively contrary.

The coils are 27.6 inches in diameter. Their wires are wound, at the rate of 20 turns for the primary circuit and only 10 for the secondary one,

two light wooden sieve hoops strengthened by two cross pieces. If the two couples of coils $A_1 B_1$ and $A_2 B_2$ were exactly identical their electromotive forces would balance each other and the telephone T would be silent. But considering the impossibility of obtaining perfect identity in

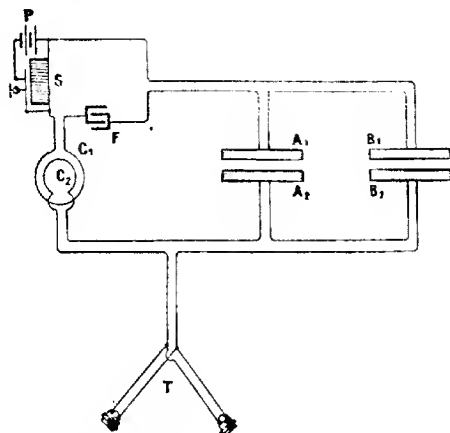


Fig. 1. — Plan of new induction balance for the detection of unexploded shells in the field

the two couples of coils, a regulating device capable of neutralising the mutual induction of the two circuits has been added. On each of the circuits a small coil of 4 turns of wire is mounted, one of these coils C_2 being within the other one C_1 on a common diameter. This rotation, by modifying the

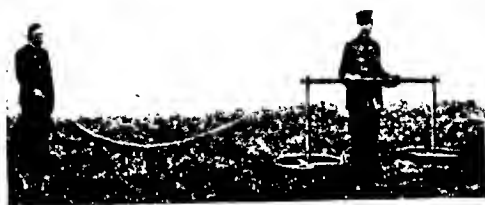


Fig. 2. — Method of locating shells in the field

mutual induction of the two circuits, allows the balance to be regulated.

When a mass of iron occurs in the neighbourhood of one of the couples of coils it produces a dissymetry which prevents compensation and causes the telephone to emit a sound.

With this apparatus, 3-inch shells buried at a depth of 16 inches have been detected and even 4 inch projectiles at a depth of over 40 inches.

The alternating current is produced by a battery P of 4 dry cells, with an interrupter S. The induced current in the interrupter coil charges and discharges a condenser F.

When the apparatus is to be used, the two coils are suspended by two vertical sticks from the ends of a horizontal bamboo which is carried by one man in such a way that the coils are kept near the surface of the field to be explored, while another man wearing a telephone head receiver and carrying the battery and the rest of the outfit duly connected with the coils and slung across his shoulders, follows at a distance of a few paces.

When one of the coils passes over iron, even if it be an empty can on the surface of the ground, the telephone produces a sound which varies, however, according to the position the iron occupies, whether on the surface or buried to a certain depth.

This induction balance is easy to manage and two trained men can explore with it about eight-tenths of an acre per hour.

675 · Review of Patents.

Tillage machines and implements.

United Kingdom 1 141,402. Manually operated mechanism for pushing a plough or cultivator through the soil.

United States 1 172,553. Plough cultivator.
 1 172,763. Abrader for disk harrow blades.
 1 172,935. Insect exterminating attachment for cultivators.
 1 172,946 - 1 173,822. Plough attachment.
 1 173,302. Wheeled plough.
 1 173,613 - 1 175,042 - 1 175,507. Ploughs.
 1 173,845. Plough wheel.
 1 173,985. Detachable plough share.
 1 174,640. Sub-soil plough.
 1 174,649. Yielding mount for ploughs and other tools.
 1 174,838. Weeder attachment for cultivators.
 1 174,842. Motor cultivator.
 1 174,921. Grain tiller.
 1 175,003. Combined weeder and cultivator.
 1 175,574. Guiding device for plough motors.
 1 175,735. Lifting plough.

Manure distributors.

United States 1 173,937 - 1 174,102. Manure spreader.
 1 173,937. Fertilizer distributor.

Drills and sowing machines.

United States 1 172,308. Corn and pea planter.
 1 174,130. Seed separating mechanism for planters.
 1 174,283. Plant setting machine.
 1 174,290. Seed covering attachment for grain drills.
 1 174,479. Planter.

AGRICULTURAL MACHINERY AND IMPLEMENTS

1 174 666. Three row corn planter

1 174 997. Planter attachment

1 175 184. Seeding machine.

1 175 326. Corn planter.

Reapers, mowers and other harvesting machines

United Kingdom 23 513. Machine for collecting, turning and raking hay

United States 1 172 289 — 1 175 713. Corn harvester

1 172 326. Power mowing machine

1 172 668. Threshing harvester

1 174 159. Grain binder.

1 174 650. Mowing machine.

1 175 209. Grain or hay loader

Machines for harvesting root crops

United States 1 173 042. Beet harvester.

1 175 416. Beet harvesting and topping machine

Threshing and winnowing machines

Spain 61 671. Improvement in the mechanism of threshing machine

61 677. Improved winnower

61 699. Improvements in threshing machines

61 713. New threshing machine

United States 1 173 291. Grain separator.

1 175 737. Rotary grain cleaner.

1 174 884. Threshing machine

1 175 016. Grain saving device for threshing machine

Machines and implements for the preparation and storage of straw, chaff, etc.

Spain 61 733. Press for baling straw or the like

United States 1 173 344. Grain elevator.

1 174 711. Potato sorter

1 175 702. Hay stacker

Other agricultural machines and implements

British India 2 299. Improvements in cotton gins

2 292. Improvements in the carding of kapok and similar fibre and the production of a fibre therefrom.

Italy * 151 021. Machine for destroying the silk worm chrysalis without injuring the cocoon.

151 531. Improvements in feedhops

151 552. Agricultural and industrial traction engine

Spain 61 760. Packing for the transport of bananas

United Kingdom 22 490. Machine for kneading, drying or washing Indian meal

22 896. Means for controlling heating of incubators

22 928. Appliance for flaying carcasses

23 795. Apparatus for collecting yeast during fermentation

23 949. Fastener for the ends of cask hoops

24 209. Animal traps.

United States 1 173 004. Tractor attachment for motor vehicles

1 173 201. Hog roller

1 174 313 — 1 175 060 — 1 175 451. Tractors

1 173 594. Frame for traction engine

976 - **Hydraulic Fill Method Used to Throw a Temporary Dam Across a Wide Stream** (1). - *Engineering Record*, Vol. 72, No. 26, pp. 791-795. New York, December 25, 1915.

The Imperial Valley in Southern California and the northern part of Lower California (Mexican territory) is irrigated by water taken from the Colorado river just above the international boundary line. The flow of the stream seldom falls below 7000 ft per second which is ample for the needs of the irrigated lands.

In 1915, however, the flow fell below the above minimum thus endangering the supply of the valley. The California Development Co. which owns the main canals and sells water to the mutual distributing companies in order to save the crops determined to throw a dam across the stream thus diverting the entire flow into the irrigation canal.

For various reasons it was not advisable to put a permanent structure across the river; besides, immediate relief was needed. It was therefore decided to build some temporary earth filled structure, and as dry earth handling methods could not be adopted as only the light alluvial soil could be economically used, hydraulic carriage methods were resorted to, using the heavier materials which are to be found under the present stream bed. These consist of stones up to 6 inches in size and a mixture of clay, alluvium and gravel which when wet has considerable strength and comes through a 10 in. dredge pipe in lumps as large as 6 or 8 in.

It was proposed to deposit this heavier material along the centre line of the dam, so as to form a core, while the lighter stuff would be carried off by the water and partly lost and partly deposited on the upstream and downstream toes.

A 10 inch section dredge with ladder and suction pipe long enough to reach to a depth of 15 ft. below the stream bed was set to work on August 12. The river at that point was 900 ft. wide and 6 to 7 feet deep. In 14 days the dredge carried the dam to an elevation of 12 in. above water level and within 250 ft. of the opposite shore. As the fill rose, two lines of light poles about 30 feet apart were jetted into it and quantities of willow and cottonwood brush piled against them to form two fences between which materials were pumped until the dam was 5 ft. above water level. The result was a dam with a base width of about 150 ft. and a crown of 30 ft.

When the work was started the velocity of the current was 2 to 3 ft. per second. As the channel decreased the velocity increased and at closure was about 6 ft.

As the stream is subject to rapid rises, arrangements were made during construction so as to be able to cut it easily, by light blasting, in two places and quickly create two 150 ft. channels.

Before beginning the closure, the bottom was carefully lined with about 10 000 sacks filled with heavy material pumped up by the dredge. The closure, which was made in a water velocity of about 6 ft. per sec. and at the last instant in a depth of about 22 feet of water, was effected with

(1) See also *B. March* 1915, No. 315.

BUILDING CONSTRUCTION

the aid of cottonwood and willow brush. This consisted of young trees 6 to 10 in. thick at the butt and 20 to 30 ft. long. Two 1 $\frac{1}{4}$ in. steel cables were stretched across the gap to afford support to the butts of the young trees while bundles of brush weighted with earth filled sacks were thrown together with the discharge of the dredge. Closure was effected on Sept. 20.

The structure remained intact till October 3, when owing to a rise of the river it became advisable to blow up the closure section.

According to measurements, the dam contained 30,000 cubic yards of material while the pumping records indicated 40,000 as the quantity raised. The difference is probably due to the fine material washed away.

The cost of pumping was as follows:

Labour	\$ 578.48
Fuel oil (13,000 gals)	116.00
Other oil etc.	200.00
	\$ 894.48

On the basis of 40,000 cu. yds. pumped this would give a cost of 2.7 cents per cu. yd. The length of pumping line was never greater than 300 ft.

The total cost of the work was as follows:

Earthwork (dredge)	\$ 1,400.00
Brush and poles	315.00
Sacks	1,110.00
Wire	67.00
Cable and clumps	400.00
All labour	894.48
10 per cent for supervision	100.00
	\$ 3,186.48

Against this cost should be set the increased revenue of from \$ 700 to \$ 1,200 per day from the sale of the water.

It is expected that the present structure will in part be carried away by high water but that a considerable base will be left as a foundation for a similar structure next year, should it prove necessary.

67 - **A Dry Heat Sterilizer.** - AQUINAS, P. in *The Gardener's Chronicle*, Vol. 1, IX, Third Series, No. 3914, p. 10, London, January 1, 1916.

The excellent results that follow sterilisation of the soil have been recognised both by scientists and by practical men.

The principle of the operation is to heat the soil to a temperature which will destroy any animal or vegetable organism that it may contain and that might be harmful to crops.

The original practice was to circulate steam in the soil, but this method is onerous and difficult, except where the quantity of soil to be treated

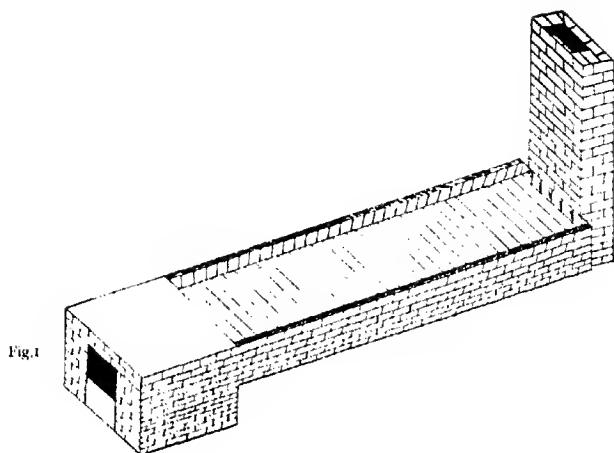
A dry heat steriliser for soils.

Fig. 1



Fig. 2

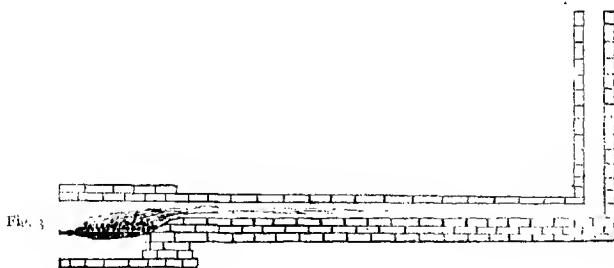


Fig. 3

Fig. 1: General View.

Fig. 2: Horizontal section.

Fig. 3: Longitudinal section.

is sufficient to justify the outlay. Dry heat sterilisation has thus been resorted to, and has been found more suitable for the small market growers and private gardeners.

The stove illustrated in the accompanying figures (fig. 1 general view, fig. 2 horizontal section and fig. 3 longitudinal section) is suitable for the purpose; it is built entirely of bricks and will consume any kind of fuel as well as garden refuse.

The floor on which the soil is placed is heated by four flues under it, running from the furnace at one end to the chimney at the other. Its length may vary, according to requirements, up to 15 feet. The overall width is 4 ft. 6 in., the furnace is 1 ft. 6 in. wide, though it may be made wider when it is intended to burn chiefly refuse. The chimney rarely need be more than 4 ft. over the floor of the steriliser unless the stove is situated between high buildings. The outside walls are raised the height of two bricks from the floor to hold the soil and to facilitate covering it during the process of sterilisation.

Once the stove is heated thoroughly, the temperature of the soil reaches 130° to 140° F. It is left for two or three hours, when it is turned and left again for a similar period.

The heat is more accentuated when the soil is in a moist condition (but not excessively) and kept covered with bags. The temperature to which the soil is heated by this means is certainly lower than when steam sterilisation is practised, but the length of time the soil is kept at such a temperature compensates for this deficiency, and experience proves the result to be equally beneficial to the crop.

RURAL ECONOMICS.

078 - **Influence of the Size of Farms on their Gross Yield.** LAURENCE in *Archiv für exakte Wirtschaftsforschung (Jahrbuch Archiv)*, Vol. 7, Nos. 2 and 3, pp. 218-227, Jena, 1916.

The methods of enquiry adopted by German writers in determining the relations between the size of a farm and its gross return are first dealt with. It is noted that the results of certain farms have been generally ascertained by the business books and question sheets, the farms being afterwards classified according to size. It has not been possible to make use of the account books except in few cases, and most of the accounts were not even classified and checked by the enquirers. Among the figures determined by the German Agricultural Accounts Office only those furnished by the "Deutsche Landwirtschafts-Gesellschaft" (German Agricultural Society) can be utilised. The enquiries of German writers therefore have not sufficiently cleared up the problem, and this can only be done by comparing the results obtained by the proper keeping of accounts on a large number of farms. It is held that the enquiries made since 1901 by the Swiss Peasants' Secretariat, which to-day cover 2878 closed accounts, are more accurate from

TABLE I. — *Gross Return per Acre with Forest.*

Year	Small farms (7-12 acres)		Small peasant farms (12-24 acres)		Peasant farms (24-37 acres)		Large peasant farms (37-74 acres)		Large farms (above 74 acres)	
	Number of farms	£ per acre	Number of farms	£ per acre	Number of farms	£ per acre	Number of farms	£ per acre	Number of farms	£ per acre
		£ s. d.		£ s. d.		£ s. d.		£ s. d.		£ s.
1901 . . .	11	9 6 1	38	8 19 9	34	1 15 2	23	6 17 2	4	5 18 4
1902 . . .	—	—	—	—	—	—	—	—	—	—
1903 . . .	16	13 0 5	39	10 10 2	42	8 11 2	29	8 9 2	10	8 13 4
1904 . . .	24	12 17 6	62	10 2 —	48	8 11 2	42	8 10 10	6	5 16 4
1905 . . .	22	17 12 3	82	10 10 2	38	7 11 6	49	8 14 11	11	6 8 1
1906 . . .	25	11 17 —	94	11 15 2	48	9 7 9	50	8 14 0	13	7 2 4
1907 . . .	24	13 12 3	101	11 10 7	60	8 15 2	52	9 16 9	13	7 11 7
1908 . . .	20	12 13 8	115	12 1 3	62	10 2 7	63	9 14 2	18	8 14 14
1909 . . .	39	13 6 10	114	12 1 3	63	10 8 11	42	10 2 2	18	8 9 3
1910 . . .	38	14 8 7	110	12 8 11	61	11 12 11	42	9 15 2	19	8 0 3
1911 . . .	31	14 14 11	126	13 4 7	63	11 17 11	40	10 6 0	17	8 6 1
1912 . . .	27	12 15 5	133	14 8 3	66	12 18 6	40	11 16 1	19	10 12 5
1913 . . .	29	15 3 7	126	12 8 11	73	10 11 9	58	10 3 5	17	8 1 3
Totals and averages										
1901-1913	315	13 15 9	1149	11 13 8	658	10 0 6	512	9 8 2	165	7 15 0

TABLE II. — *Comparison between Gross Return of Small Farms and other Farms with Forest.*

Year	Small farms	Small peasant farms		Large peasant farms		Large farms
1901 . . .	100	98	83	74	62	
1902 . . .	—	—	—	—	—	
1903 . . .	100	83	80	65	67	
1904 . . .	100	74	62	62	43	
1905 . . .	100	60	41	50	36	
1906 . . .	100	99	79	73	60	
1907 . . .	100	85	65	72	50	
1908 . . .	100	95	82	77	69	
1909 . . .	100	90	78	76	63	
1910 . . .	100	86	81	68	56	
1911 . . .	100	90	79	70	57	
1912 . . .	100	89	80	73	66	
1913 . . .	100	82	70	67	53	
Averages						
1901-1913	100	84	72	68	57	

TABLE III. — *Gross Return without Forest per Acre of Unrested Area.*

Year	Small farms (7-12 acres)			Small peasant farms (12-24 acres)			Peasant farms (24-37 acres)			Large peasant farms (37-74 acres)			Large farms above 74 acres			
	Number of farms	£		Number of farms	£		Number of farms	£		Number of farms	£		Number of farms	£		
		per acre	s		d	per acre		s	d		per acre	s		d	per acre	s
1901 . . .	11	10	10	6	38	10	6	8	34	9	12	8	23	3	19	7
1902 . . .	7	11	0	1	45	10	9	3	18	9	2	9	12	8	9	2
1903 . . .	16	13	4	1	30	11	11	3	12	11	11	3	20	9	2	1
1904 . . .	24	14	9	3	62	11	2	0	38	9	11	3	42	9	2	2
1905 . . .	22	17	14	0	82	11	8	9	38	9	14	14	19	9	12	1
1906 . . .	25	17	18	6	94	12	13	3	48	10	18	2	30	9	10	8
1907 . . .	24	14	12	7	101	12	17	5	60	1	0	9	52	11	0	9
1908 . . .	29	13	10	4	115	13	0	15	62	10	6	10	61	10	18	6
1909 . . .	30	14	0	10	114	13	6	2	63	11	12	0	42	11	10	4
1910 . . .	38	15	10	4	110	13	12	0	61	12	18	9	42	10	19	9
1911 . . .	31	16	0	9	120	14	5	0	63	12	2	4	40	11	9	1
1912 . . .	27	17	10	7	133	15	12	10	60	14	8	0	40	13	4	10
1913 . . .	20	11	6	4	120	13	9	8	33	11	6	6	58	12	9	0
Totals and averages																
1901-1913	322	14	2	5	1158	12	11	10	6,4	10	12	2	554	10	8	6

TABLE IV. — *Comparison between Gross Return of Small Farms, and other Farms without Forest.*

Year	Small farms	Small peasant farms	Peasant farms	Large peasant farms	Large farms
1901 . . .	100	98	84	6	98
1902 . . .	100	99	84	22	100
1903 . . .	100	87	87	60	69
1904 . . .	100	77	66	60	47
1905 . . .	100	94	94	44	11
1906 . . .	100	99	84	4	60
1907 . . .	100	85	67	14	32
1908 . . .	100	96	86	21	64
1909 . . .	100	95	82	24	60
1910 . . .	100	88	84	4	3
1911 . . .	100	99	84	12	58
1912 . . .	100	89	82	15	69
1913 . . .	100	84	66	13	33
Averages					
1901-1913	100	87	77	12	49

this standpoint. These accounts are kept on a uniform system on peasant farms, and are continually verified.

In the following chapter the writer refers to his investigations for the purpose of ascertaining, by means of the above material, the relation between the size of farms and the gross return, for Switzerland. By "gross return" is meant the gross final return of the entire business, that is, the gross return of all branches of the agricultural undertaking. There are considerable difficulties in the way of determining this. In order to compare the gross returns of different farms, they must be determined on the same methods, or at least according to uniform principles. At the request of the International Institute of Agriculture, the writer formulated principles for the estimation of the gross return based on the method adopted by the Swiss Peasants' Secretariat (1). The enquiries made by the Swiss Peasants' Secretariat determined the gross returns per acre *with* and *without* forest; the writer proceeded in the same way.

Table I classifies the gross returns per acre with forest according to the size of the farms. In Table II the gross return of small farms states as 100 is compared with that of the various other descriptions of agricultural undertakings with forest (see following page).

It appears from this that the gross return per unit of area increase regularly in proportion as the size of the undertaking diminishes. The influence of the size is so great that it is evident even in the simple yearly results. The constancy of this relation is the more striking in view of the fact that part of the farms in question undergo changes from year to year. The accounts moreover are kept under different conditions. Part of them deal with intensive cultivation of the Swiss tableland, while others relate to farms in the high mountainous regions. The farms are not selected, but are admitted to the checking scheme following upon a simple entry. From all these facts it is concluded that, in enquiries of this kind, the number and accuracy of the observations are more important than the question whether the conditions under which the results are obtained are comparable with each other.

The calculation of the gross return may be affected by the area under forest and pasturage. In the enquiries of the Swiss Secretariat the forest is only considered in the "agricultural" account in so far as it may serve to supplement the farm work proper; its effect therefore is slight. The gross yield is also calculated per unit of area without forest. In Switzerland it is not usual for pasturage of any extent to belong to the farmer, except in certain parts like the Jura. In others, pasturage is in the hands of agricultural societies and corporations. The yields of these pasturages, which are not included in the area of the farm, increases, though very slightly, the comparative gross return per unit of area. In order to measure this increase the writer calculates a "pasturage factor", reducing the quantity of farms consumed on pasturages outside the property to the yield of grassland

(1) See, in B. 1914, pp. 193-208, the article by Dr. Lamm entitled: Principles for Preparation of International Statistics of Agricultural Accounts.

of average productivity by estimation. On multiplying this factor by the return obtained per unit of area of the farm, there is obtained the gross return of farm working including pasturage.

Table III indicates the gross return without forest per acre of unforested area, and Table IV compares the gross return of small farms taken as 100) to that of various other descriptions of farms without forest (see above).

These figures also show that the gross returns increase in proportion as the size of the farms diminishes.

The writer has also classified the figures ascertained by the Swiss Peasants' Secretariat according to the different systems of cultivation and size of farms. The results for some of the principal groups for the years 1904-1913 are indicated in Table V.

It is also seen here that the larger the farm the smaller the gross return, but exceptions are more numerous than in the Tables where all the farms were taken into account, owing to the fact that in Table V the years affect the results, and the number of completed accounts for many groups is still so small that the personal influence of the farmer, the position of the market, the system of working, natural factors, etc. may still make themselves felt. All these exceptions, however, cannot modify the fact that the gross return is larger in proportion as the farm is smaller, a fact which the writer regards as being scientifically established for Switzerland.

The enquiries of the Swiss Peasants' Secretariat also show what portion of the gross return is used for supplying the farmer's family and what portion is sold on the market. Taking an average of the years 1904-1913 the aggregate gross return (with forest) was utilised as shown in Table VI.

TABLE VI. — *Utilisation of the aggregate Gross Return with Forest.*
Average for 1904-1913.

Sizes	Material		Food for home supplies	
	per cent.	£ per acre	per cent.	£ per acre
		£		£
Small farms	67.06	6.8	23.4	2.3
Small peasant farms	75.43	8.10	24.1	2.3
Peasant farms	78.02	7.15	24.99	2.2
Large peasant farms	84.24	7.42	19.76	1.95
Large farms	86.99	6.04	16.01	1.58
General averages	79.11	8.2	20.89	2.0

The figures show that not only the gross return but even sales on the market increase per unit of area in proportion as the size of the farms diminishes.

It is well known that small farms use a relatively larger quantity of produce for supplying the farmer's family than large farms.

In the next chapter, the results of the enquiries made by German authors are reviewed. It is concluded that in Germany too, the increase in the size of the farms reduces the gross return. The materials on which these results are based are still insufficient, but it is believed that more extensive and precise enquiries would confirm these preliminary results. In consideration of the economic importance of this question both from the private and national point of view, it would be advisable to continue these enquiries in Germany, and endeavour to obtain a definitive result based on scientific investigations. This would be most effectively secured by creating central Agricultural Accounts Offices, whose duty it would be to check a sufficient number of farms in each region by keeping careful accounts.

In the last chapter, the causes to which the larger gross return of small farms are to be ascribed are enquired into. By calculations and tables it is shown that the higher amount of yield is chiefly due to the fact that small farms are relatively better supplied with cattle, which also results in an enhanced value of crop production. Besides these, there are a number of other branches, such as arboriculture, vine-growing, bee-keeping, poultry-keeping and market-gardening, special to small farms, which contribute to increase the gross return. In addition, in calculations based on accounts, the repayment by the "private" account to the "agricultural" account also increases the gross return of the farm.

Finally, some questions requiring still more thorough study in order to solve the problem of the best size of farm are touched upon. The data points to be determined by thorough enquiry are : the amount of return per unit of produce of the soil ; the influence of the quantity of livestock on the final gross return of the farm ; the productive capacity of farms generally as regards supplies in particular for home supplies and the market.

Probably the small farm yields larger money values per unit of area and also produces a bigger money value for the market, but at the same time furnishes less of nutritive elements (thermal units and starch value) for human sustenance than the large farm chiefly engaged in growing crops for the market. The writer proves by calculation that the larger the number of livestock relatively to the farm, and consequently the smaller the latter, the lower is the production of nutritive elements for human food. His figures suggest that the large farm, chiefly engaged in crop-growing for the market, is of special importance in countries where industrial wages are low and where the people live chiefly on vegetable products, but that in countries rapidly increasing their national wealth, and where wages, the exportation of manufactured products, and the consumption of meat are on the increase, the importance of small farms likewise grows. From the point of view of intensive livestock production, there is certainly a difference between the productivity of the large and the small farm. From the point of view also fresh enquiries are needed into the gross return of different sizes of farms.

TABLE V. *Gross Return of Farms Classified according to System of Cultivation (1904-1905).*

System of Cultivation	Small farms				Small peasant farms				Peasant farms				Large peasant farms				Large farms			
	Number of farms	£	s	d	Number of farms	£	s	d	Number of farms	£	s	d	Number of farms	£	s	d	Number of farms	£	s	d
Farms with improved three-year rotation	63	12	8	10	277	10	8	5	73	10	10	10	41	8	8	0	3	6	18	6
Baron	7	12	8	5	44	12	8	5	47	10	14	1	57	11	—	—	21	10	9	2
Lauxelle	2	16	2	6	55	13	11	3	55	12	0	11	13	10	14	11	15	11	11	2
Solaire, Bâle-Champagne, Argau	10	16	12	2	53	11	16	1	16	9	12	0	37	8	6	4	1	8	18	2
French Switzerland	1	17	6	6	66	11	1	0	28	9	0	5	39	9	9	4	25	8	3	0
Stock farms with cultivation	21	14	8	0	116	12	10	2	45	9	0	3	32	11	10	4	3	7	15	6
on the Swiss German plateau	30	12	4	0	167	14	12	3	55	10	14	0	26	11	6	6	16	9	0	5
in the Alpine valleys	46	17	6	10	80	10	15	11	59	9	19	7	23	8	3	2	8	3	4	2
in the special fruit-growing regions	—	—	—	—	46	19	8	5	28	15	13	1	27	14	1	10	—	—	—	—
with pastureage	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lucerne	1	10	8	7	16	17	8	9	9	10	2	30	7	12	6	5	11	15	1	1
Alpine farms	4	10	12	10	50	8	7	5	28	6	18	10	12	3	14	2	6	2	8	3
Farms of the high valleys of Aletsch and other ranges	34	10	10	5	36	10	3	3	11	6	8	14	7	14	2	—	—	—	—	—

AGRICULTURAL INDUSTRIES.

679 - "Natural Wheat Bread". — *L'Agricoltura toscana*, Year VII. Part 8, pp. 17-19.
Florence, April 30, 1916.

In the municipal bakery of Bergamo (Italy) the manufacture of "natural wheat bread," i. e. bread obtained from the whole grain, has been undertaken with excellent results.

The wheat after careful cleaning and sifting is put into a bath of lukewarm water in which it is steeped for 48 to 60 hours according to its hardness. During this steeping the wheat is "vitalised", that is to say, the germ begins to develop and the constituents of the integument soften and change in a marked degree. The wheat when vitalised to the required extent is put into a grinding and kneading machine, where it is converted into dough, from which the loaves ready for baking are cast. All milling operations are thus eliminated and with them every risk of adulteration and deterioration of the flour. The "natural bread" is grey in colour, of very pleasant odour and taste, and much superior in nutritive qualities to common white bread, being rich in fats, vegetable lecithin and pepsin.

As the whole of the wheat is utilised, the returns are very high: at the municipal bakery of Bergamo, in February 1915, the wheat converted into bread yielded for 100 lbs weight, an average of 136 lbs of "natural bread" with an average of 26 to 27 % of moisture. On the other hand, with ordinary methods of bread-making, even when flour which gave 85 % bolting is used, 1 cental of wheat cannot yield more than 102.2 lbs of bread, reckoning a yield of 120 lbs of bread per cental of flour.

The Bergamo bakery sells the "natural bread" in small rolls of just over 2 ounces at the price of 2d per lb.

680 - Chemical Comparison between two Fermented Milk Products: the "Labna raieb" of Egypt and the "Miciuratu" of Sardinia. — SANNA A., in *Le Stazioni sperimentali agrarie italiane*, Vol. XLIX, Part 2, pp. 773-88. Modena, 1914.

The product termed "miciuratu" in Gallura (north of Sardinia) which it is largely consumed, and "gioddu" in the rest of Sardinia, is prepared as follows: After boiling milk (cow's, ewe's or goat's, or a mixture of the three) for 5 or 6 minutes, it is poured off and allowed to cool to a temperature slightly above 37° C. in a specially made wooden vessel; the ferment diluted in warm milk is then added, the whole is mixed and the vessel covered with a piece of woollen cloth and left standing for about 7 hours, the milk is then found to be curdled into a doughy mass and the "miciuratu" is ready.

The preparation of "labna raieb" is almost the same as that of "miciuratu". In any vessel (as big as possible) cow's or ewe's milk is heated without bringing to the boil (up to about 80° C.) until reduced to about one-third of its original volume; it is then poured off into small vessels and allowed to cool to 35° C. Next, by means of a syringe, and without mixing the liquid, the surface of which is covered with cream, 5 cc. of "labna raieb" is added on the day before and previously diluted in a small quantity of milk.

ged as above, is added for each 1½ pint of reduced milk. The vessels are wrapped in cloth, so that it retains a temperature of about 35°C. for 5 days (during which period it coagulates), the cloth wrapping is then removed and cooling takes place.

The analysis of "micinratu" prepared with cow's milk at the cheese factory of the Oenological School of Cagliari gave the results shown in table I.

TABLE I. — *Percentage Composition of "Micinratu".*

Components	Milk before fermentation	Milk after 8 hours fermentation	"Micinratu" after 1 day	"Micinratu" after 2 days	"Micinratu" after 3 days
Density	1.368	—	—	—	—
Rain	13.00	—	—	—	—
As	5.9	5.8	5.8	5.94	4.94
After	82.40	—	—	—	—
Cruct	17.60	—	—	—	—
Ch	0.843	—	—	—	—
Solility	0.25	0.68	1.072	1.350	1.620
sein	4.321	—	—	—	—
humen	0.0097	1.863	4.028	4.900	4.68
ugar	4.024	3.485	2.004	2.380	2.240
lycerine	—	traces	traces	clearly marked traces	clearly marked traces

The acidity certainly continues to increase even after the 3rd day, but beyond that time the product becomes unfit for use owing to lactic fermentation. The acidity is chiefly due to non-volatile acids (lactic and succinic). The acidity due to volatile acids on the 3rd day was 0.03 per 1000, the presence of acetic and formic acid was observed. Traces of ethyl aldehyde were detected in "Micinratu" and also ethyl alcohol in the following proportions:

After 8 hours	0.15 per 1000
After 1 day	" 4 "
After 2 days	1.70 "
After 3 days	1.06 "

These results prove that during the conversion into "micinratu" the 3 principal constituents of milk—sugar, fats and nitrogenous substances, undergo well-marked fermentation. The most notable is the fermentation of the sugar with formation of lactic acid. There are likewise other products of oxidation, such as ethyl-alcohol and ethyl aldehyde. To judge from organoleptic analyses, acetic ether does not appear to be absent.

The pure fat is transformed, but this transformation is the least marked. The reduction in fatty matter is almost negligible. Albumen and casein undergo partial peptonisation.

The analysis of "laben raieb" made from buffalo cow's milk gave the results indicated in Table II.

TABLE II. - *Percentage Composition of "Laben raieb".*

Components	Milk before fermentation	Milk after 8 hours fermentation	"Laben raieb" after 1 day	"Laben raieb" after 2 days	"Laben raieb" after 3 days	Commercial "Laben raieb"
Density	1.032	—	—	—	—	—
Fats	8.27	8.11	8.00	7.91	7.86	3.98
Water	81.67	—	—	—	—	—
Extract	18.33	—	—	—	—	—
Ash	0.971	—	—	—	—	—
Acidity	0.20	0.72	1.184	1.640	2.100	1.130
Casein	3.495	4.150	3.864	3.505	3.487	4.008
Albumen	0.825					
Sugar	4.86	—	—	—	—	—
Glycerine	More and more distinct traces					

In "Laben raieb" also there was observed the presence of peptones, ethyl-aldehyde and ethyl-alcohol; the latter in the following proportions (averages of 2 observations):

After 8 hours	0.14 per 1000
After 1 day	0.30
After 2 days	2.35
After 3 days	2.05

Conclusion.— "Miciuratu" may be considered as not differing chemically from "Laben raieb". The fact of the same products of fermentation being found in both suggests that the ferments are also the same (1). It is true that the fermentation of the sugar, and consequently the production of alcohol, are more intense in "laben raieb" and that the contrary is the case in the fermentation of the proteid substances, but only slight quantitative differences are concerned, which may be explained by the difference of concentration of the two products and the difference in temperature of the two countries of production.

(1) In "Laben raieb", E. Rist and J. Khoury (*Annales de l'Institut Pasteur*, Vol. 16, p. 65) found the 5 ferments: *Streptobacillus lebanensis*, *Bacillus lebanensis*, *Diplosarcus lebanensis*, *Saccharomyces lebanensis*, and *Mycoderma lebanensis*.

11. **Fine and Coarse Wool of Russian Sheep.** See No. 608 of this *Roll* for

12. **The Viscosity of Beeswax and the Substances used for its Adulteration.**

FARRIS UGO, in *Le Stazioni sperimentali di agricoltura*, Vol. XLVIII, Part 2, pp. 585-611, Modena, 1915.

The writer has applied the method of viscosity measurement to the analysis of beeswax, taking the viscosity of nitrobenzol as the standard of comparison. The results are given of the measurements made not only with virgin wax and bleached wax, but also with the substances most used in adulterating these products. The following Table reproduces the maxima and minima found for the viscosity index of the different substances (ratio between the time taken by the substance in question and that occupied by nitrobenzol in flowing between 2 points of reference of the viscosimeter).

The great difference between the viscosity index of beeswax and that of the other substances mentioned, together with the simplicity and rapidity of its determination, lead to the conclusions that this index is of great value in the analysis of wax, and may even at times be used for detecting adulterative proportions.

*Viscosity Index of Beeswax and of the Substances most used
in its Adulteration.*

	Maximum	Minimum
Virgin beeswax, from different Italian localities	16.30	15.23
White wax	17.83	16.84
Caranuba wax	13.93	12.01
Japanese wax	21.17	20.74
Tallow	11.05	10.49
Stearin	8.30	8.11
Spermaceti	7.17	6.71
Paraffin and ceresine	6.64	5.18

PLANT DISEASES

GENERAL INFORMATION.

683 - **Ordinance relating to Insect Pests and Diseases of Plants, in Western Samoa.** --
British Military Occupation of Samoa. Proclamation No. 25.

Under date of the 2nd February 1916, the Acting Administrator of Samoa promulgated the following order:

1) All soil, plants, fruit, tappas, native matting, curios or other articles hereafter imported or brought into the Islands of Western Samoa and liable in the opinion of the Commissioner of Agriculture at Apia to be affected with insect pest or other disease shall be subjected to such fumigation or other treatment as the Commissioner shall deem necessary for the destruction of such pest or disease.

2) No importation of soil, plants, fruit, tappas, native matting or curios shall be made except through the port of Apia and the person importing or bringing such articles shall notify the fact to the Commissioner or to the Collector of Customs or in the case of postal packages to the Post Master at Apia. No such importation shall be removed from the Custom House or the Post Office, as the case may be until inspected and passed by the Commissioner.

3) No soil, plants, fruit, tappas, native matting or curios shall be shipped or posted or received for shipping or posting from the Islands of Western Samoa unless accompanied by a certificate of the Commissioner to the effect that such exportation has been passed as free from pest or disease or has been fumigated or otherwise treated for the destruction of same.

4) Every such exportation shall be notified to the Commissioner and deposited at the Fumigation Station for treatment at such time before the departure of the vessel or the closing of the mail by which it is to be shipped or posted as the Commissioner shall require.

5) The following fees shall be charged for fumigation or other treatment for the destruction of pests or disease whether upon imported or exported articles:

(a) for each box or parcel treated	3d.
(b) for each plant treated	3d.

6) Any breach of any of the provisions of this ordinance shall be punishable by the Courts constituted under the Civil Administration of Western Samoa by fine not exceeding five pounds or by imprisonment for not more than 30 days.

83 - Decree including the "Abrojo grande" (*Xanthium macrocarpum*), among Weeds in Uruguay. -- *Revista de la Legislación rural del Uruguay*. Year XLIV, No. 12, p. 724. Montevideo, 1915.

Under date of the 9th October 1915 the President of the Republic of Uruguay decreed as follows:

Art. 1. — The plant known under the scientific name of *Xanthium macrocarpum* (= *X. canadense*) and the vulgar name of "Abrojo grande" is declared to be included among weeds.

Art. 2. — The "Defensa Agrícola" will in each particular case advise such means as it considers appropriate for controlling this weed.

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

85 - Factors Contributing to the Lodging of Wheat. — RIVERA V. In *Le Stazioni sperimentali agrarie italiane*, Vol. XLIV, Part 3-4, pp. 1286-1293, Pl. 1. Modena, 1916.

In previous publications (1) reference was made to the great influence of a reduced distension of the tissues on the constitutional susceptibility of plants to certain fungus attacks; an enquiry, therefore, into the factors contributing to reduce distension in cultivated plants, is of great importance and may help to elucidate the causes of their liability to certain diseases.

By experiments carried out under glass or in the open at the Royal Station of Plant Pathology in Rome, with cultivations in pots on different media containing salts in different proportions and irrigated, the effect of these factors on the lodging of wheat ("Noé", "Gentil rosso" and "Marzuolo ferrarese") was studied. The results obtained and the analysis of differently treated plants led to the following conclusions:

Complete manuring was found to favour lodging more than anything else. Plants fully manured with normal doses of salts proved very liable to lodge as compared with those raised on unmanured soil. The latter on examination showed a larger percentage than the former in dry substance, that is, a smaller quantity of water in the tissues.

The high percentage of water in the tissues is a constant indication of liability to lodging. Such liability is constantly observed not only in plants manured in the ordinary way, but also in plentifully irrigated cultivations and in those which are not sufficiently thinned out.

Among the factors which give rise to the formation of tissues of low consistency (very watery under examination) the following therefore rank in the first place: high content of nutritive salts in the soil, abundant moisture and insufficient light.

(1) See B. Dec. 1913 No. 1345 and B. May 1915 No. 539.

Each of these three factors taken by itself produces a certain degree of tendency to lodge; this tendency is increased under the combined action of two of these factors and attains its maximum when all three operate together.

Among the factors giving rise to the formation of tissues of a more solid character (plants not liable to lodge) reference must be made to the insufficiency of nutritive salts in the soil, dryness and light.

A prolonged drought, therefore, in plants raised in poor soil and kept in full light, produces the lowest degree of tendency to lodge.

The combination of two factors with opposite action moderates the effect of each. Thus there is little tendency to lodge in the case of plants which are manured, but poorly irrigated.

The factors determining the formation of tissues of insufficient consistency, the indication of which is a high percentage of water, are the true causes of lodging as found by experiment; the immediate cause, however, always consists in some drying factor (usually heat). It is concluded from this that the fall of the culm is brought about by the softening of the tissues of which it is built up. The fact that lodging of the culm is constantly preceded by obvious withering of the leaves argues in favour of this explanation.

The explanation of the fact that plants raised and maintained in a soil very rich in water wither and drop more easily than those raised in dry soil might be found in the difficulty of any regulating action in the former, by which the corresponding distension by water might be restored to the parts above ground, this difficulty being due to the development in inverse directions of the absorbing root surface and that of the aerial evaporation and transpiration organs. This same fact, which is also observed in manured as compared with unmanured plants, may explain, at any rate partly, the greater predisposition to softening of the tissues in the former as compared with the latter.

686) - "Sordago" Disease in the "Marvel of Peru" (*Mirabilis Jalapa*).

CORRENS C. in *Jahrbücher für wissenschaftliche Botanik*, Vol. 30, pp. 585-616. Leipzig, 1915.

The leaves of the plants attacked showed small light brown blotches on the surface, giving them a spotted appearance. Young plants and the roots of *M. jalapa* did not at first show any irregularity, but after a time the old leaves showed the characteristic spotting. Little by little, the disease also attacked the younger leaves. The symptoms started at the pointed apex of the leaf and progressed towards the leaf-stalk. The twigs, leafstalks and green fruits never showed any spots. The spots were often so numerous as to touch one another; they only appeared on the upper face of the leaf. The diseased leaves lived nearly as long as the sound ones.

The moment the disease appeared, the plant became sickly and greatly retarded in growth.

The spotting of the leaves occurs in all forms of *M. jalapa*, which are distinguished from each other by their content of chlorophyll. It was found both in the *typica* form and in the *chlorina* and *variegata* forms. To the

form *semichlorina* alone, which is intermediate between *chlorina* and *typica* it was not possible to transmit the disease.

The brown spots give the chlorophyll a characteristic dirty hue, hence the writer calls the diseased plants "sordidae" and the disease "sordago."

An examination of the part attacked proved that the disease commences in the palisade cells. The cells die under the influence of an agent as yet unknown, and are then transformed into an amorphous mass which undergoes decomposition. The epidermic cells were never attacked first; generally they were only attacked after the palisade cells were completely destroyed. The cells below the palisade cells never exhibited any symptoms of disease; it is therefore localised to these latter.

The diseased plants studied originated: *a*) from a culture made about 20 years ago with the form *variegata* which was probably already diseased; *b*) from a plant belonging to the group *glaucoscutata* (dark leaves), which was certainly free from the disease. This latter plant, in 1910, after self-fertilisation, produced progeny to the number of 65, of which 14 had "sordago" disease.

The sister plants of those which produced "sordidae" having all produced healthy progeny, the conclusion was drawn that the parent plant of the "sordidae" is the product of a mutation of the sexual cell of *M. jalapa*.

As *M. jalapa* cannot stand the winter cold, the roots are kept in cellars during the cold period. It has been found that individuals suffering from "sordago" retain the disease for years. Young plants at first showed no growth anomalies, but after a time the spots appeared on the leaves. The characters of the disease are not influenced by external factors. On the other hand, plants which were not attacked in the first year remained free afterwards.

"Sordago" is hereditary and is transmitted according to Mendelian laws.

When a plant normal in appearance, after fertilisation, produced healthy and diseased offspring the latter were generally in the proportion of 25 per cent. The parent of this offspring was therefore heterozygous normal ÷ ("sordidae") with the "normal" state dominant over the "sordago" state. This fact is confirmed by the characters of the progeny in further generations.

By cross-fertilisation of "sordidae" plants, diseased progeny exclusively was obtained. All the progeny therefore were homozygous.

On cross-fertilisation of healthy plants, it was found that one third produced only healthy progeny and two thirds gave both "sordidae" and healthy in the proportions of 1:3.

From this it is concluded that we are confronted here with typical monohybridism in which the character of the "sordidae" plants is recessive to such an extent that it is impossible to distinguish the normal homozygotes from the heterozygotes. All these facts result from numerous experiments of which a full description is given.

The experiments also show that the "sordidae" plants are much

lighter and smaller than the normal ones, probably owing to deranged metabolism.

The study of this interesting disease is being continued.

1937. — **"Spike Disease" in Sandal, in India.** LUSHINGTON P. M. in *The Indian Forester*, Vol. XLII, No. 2, pp. 61-65. Allahabad, February 1-16.

The disease of the sandal tree known in India as the "spike disease" first described by Mc CARTHY in 1902, has been widely prevalent latterly causing great damage in Germalam, Bytur and Jadathiadi Halla in North Coimbatore, the Gundal valley, Hassanur, and Thattakarai on the Burgur plateau.

In the Southern circle there are two infected areas at Iowlagiri and Tholuvabetta, which are separated by an 18 mile belt partly wooded, where no diseased plants occur; LATHAM recently found an infected tree, quite an isolated case, at Salem, 60 miles south-east of Tholuvabetta.

In the Trichinopoly district, there are the two infected localities of Jambuthu and Chellapotti separated by entirely immune belts and situated at a great distance from the other infected areas.

The infection is very virulent: the disease spreads rapidly from one tree to all the surrounding plantations, causing heavy ravages. Although birds and insects can convey the fungal spores over wide distances, the disease, to judge from the geographical distribution of the infected areas, is endemic in character.

Little is known about the cause of the "spike disease". The present position of the question may be summed up as follows:

1) The chief symptom is phyllody accompanied by excess of starch in the stem, twigs and leaves.

2) In the trees attacked the root ends die and the haustoria are either absent or dead.

3) The refuse of diseased trees is sometimes normal, sometimes infected with phyllody.

4) Specimens are often observed in which only some parts of the branches and stem show signs of disease, all the rest remaining healthy. The pruning of unhealthy parts does not stop the disease, the plants always dying.

5) Healthy young seedlings are frequently observed in diseased areas under cover of scrub, which appears to protect them; they are liable to the disease however the moment they get their heads above the scrub.

6) No trace of fungus disease was found and attempts to infect by means of contaminated material were quite negative in results.

7) Other trees besides the sandal are attacked by a disease having an appearance similar to "spike", for instance *Zizyphus Oenoplia*, *Dodonaea viscosa*, and *Pterolobium indicum*. No relation has yet been established, however, between these different diseases.

DISEASES DUE TO FUNGI, BACTERIA
AND OTHER LOWER PLANTS.

88 - **Vegetable Parasites of Cultivated or Useful Plants observed in 1913 in the Government of Tula, Russia.** - Treubov J. in *Materialy k izucheniyu rasten'nykh boleznei v Rossii*, Year I, Part 1, pp. 38-39. - Pechenkin, 1914.

I) *Secale cereale* L. - *Tilletia secalis* Kühn has only been reported on one farm in the district of Aleksin, where 20 per cent. of the plants were infected. *Urocystis occulta* Robb. appeared almost everywhere to a lesser or greater extent from the 25th May, when it was first reported in the district of Odoiev. *Claviceps purpurea* Tul. made its appearance, on the 15th July, in the district of Tula, but it spread very little and did not occasion damage of any extent. *Puccinia graminis* Pers. was rather rare. On the other hand, *P. dispersa* Eriks. and Henn. was a little more frequent, especially in the districts of Tula and Novossil. *Fusarium roseum* and *F. melancholicum* Appel and Woll. developed considerably, being favoured by abundant rains.

II) *Avena sativa* L. - *Ustilago avenae* Jens. and *U. levis* Magn. caused a crop reduction of 5 to 10 per cent. *Puccinia graminis* Pers. and *P. coccinifera* Kleb. occurred to a very limited extent and *Septoria avenae* was observed within areas of small extent in the district of Tula.

III) *Triticum vulgare* L. - *Tilletia tritici* Wint. broke out in the districts of Aleksin, Tula and Tchern in localities where seed from the government of Kiev (where the disease is widespread) had been sown. *Ustilago tritici* Jens. and *Puccinia triticina* Eriks. and Henn. were fairly frequent and widespread. *Septoria tritici* Desm. was reported only once, in July, on a farm in the district of Aleksin.

IV) *Hordeum vulgare* L. - *Ustilago jenssenii* Brefeld was reported in the district of Aleksin. *U. hordei* Brefeld reduced the crop of wheat by 3 per cent. *Puccinia simplex* developed to an extraordinary extent, so that hardly a leaf escaped.

V) *Panicum miliacum* L. was attacked by *Ustilago panicumiliacii* Wint.

VI) *Trifolium* spp. - The following are to be recorded: *Erysiphe trifolii* Lev., on *Trifolium repens* and *T. hybridum*; *Erysiphe polygoni* D. C. on *T. alpestre* L. and *T. medium* L.; *Peronospora trifoliorum* D. B. on *T. alpestre* in the district of Aleksin, and on *T. pratense* in the district of Tula; *Cuscuta trifolii* was observed on the 3rd July in the district of Aleksin; *Gloeosporium caulizorum* Kirchn., which spreads more and more and does greater injury every year; *Phyllachora trifolii* Fuck.; *Phyllosticta trifolii* Rich.; *Ascochyta trifolii* Bond. et Truss.; *Septoria compla* Sacc. and *Oedocephalum anthophilum* Jacz., a new disease of the flowers of red clover.

VII) *Medicago sativa* L. was attacked by *Erysiphe polygoni* D. C., *Peronospora trifoliorum* D. B., *Ascochyta medicaginis* Fuck. and *Pseudopeziza trifolii* Fuck., form *Medicaginis*.

VIII) *Vicia sativa* L. — *Septoria viciae* Westend in the district of Tula, on the 14th August.

IX) *Pisum sativum* L. — *Uromyces pisi* D. B. and *Ascochyta pisi* Loh.

X) *Melilotus albus* L. — *Erysiphe polygoni* D. C. and *Ascochyta meliloti* N. Trus. n. sp.

XI) *Fagopyrum esculentum* Moench. — *Ascochyta fagopyri* Brev. var. *tulensis* A. Bond. in the districts of Aleksin, Bogorod. Tula and Etkimov.

XII) *Triticum repens* L. — *Epichloë typhina* Tul. and *Tilletia striaeformis* West.

XIII) *Bromus inermis* L. — *Puccinia bromina* Eriks., *Claviceps purpurea* Tul., *Tilletia striaeformis* West., and *Septoria affinis* Sacc.

XIV) *Dactylis glomerata* L. — *Epichloë typhina* Tul. and *Tilletia striaeformis* West.

XV) *Poa* spp. — *Puccinia poarum* Nielsen and *Sclerotium rhizodes*; the latter attacks the leaves, which gradually wither and die; many sclerotia then appear on the dead parts of the plants.

XVI) *Solanum tuberosum* L. — *Phytophthora infestans* De Bary, favoured by wet weather, broke out with great violence; it caused a loss of crop of over 50 per cent.

XVII) *Solanum lycopersicum* L. — *Macrosporium lycopersicum* Plowr. occurred rather frequently in the districts of Tula, Odioev and Aleksin.

XVIII) *Brassica oleracea* L. — *Ascochyta brassicae* Thüm.; *Plasmiodiophora brassicae* Wor. did great damage. According to particulars supplied by the School of Agriculture of Bogoroditzk, the varieties "Bruxelles", "Krasnokocianuaia", "Savoiskaia", "Erfurth" late and early, and "Bronka" remain free; on the other hand, "Kolomenka", "Umskaia Pndovaia" and "Braunschweig" were attacked to the extent of 5, 30 and 80 per cent respectively.

XIX) *Phaseolus vulgaris* L. — *Ascochyta boltshauseri* Sacc.

XX) *Cucumis sativus* L. — *Sclerotium melophthorum* Prill. et Delacr.; *Glorosporium lagenarium* Sacc. broke out violently on young plants just transplanted, causing great damage. Good results were obtained by applying Bordeaux mixture; *Cercospora melonis* and *Fusarium lagenarium* Pers.

XXI) *Allium cepa* L. — *Peronospora schleideni* Unger and *Sclerotinia libertiana* Fuck.; the latter produced rot of the bulbs.

XXII) *Spinacia oleracea* L. — Considerably damaged by *Vermicularia herbarum* West.

XXIII) *Beta vulgaris* L. — *Cercospora beticola* Sacc. in the districts of Bogoroditzk and Aleksin.

XXIV) *Daucus carota* L. — *Sclerotinia libertiana* Fuck. causes rot of the roots which afterwards become covered with a whitish felt in which the sclerotia develop.

XXV) *Humulus lupulus* L. — *Sphaerotheca humuli* Burr.

XXVI) *Cannabis sativa* L. — *Phyllosticta cannabis* Speg.

XXVII) *Pirus malus* L. — *Phyllosticta briardi* Sacc.: apple trees in

some localities were attacked with such virulence that they lost a large proportion of their foliage in the heart of the summer; *Sphaeropsis pseudotipplodia* Delacr.; *Gymnosporangium hemelloides* R. Hartig; *Venturia naequalis* Aderh. and *Sclerotinia fructigena* Schr.

XXVIII) *Pirus communis* L. — *Gymnosporangium sabinae* Winter, *Mycosphaerella sentina* Fuck.; *Venturia pirina* Aderhold; *Sclerotinia fructigena* Schr. and *Entomosporium mespili* Jacz.

XXIX) *Prunus domestica* L. — *Phyllosticta prunicola* Sacc., *Puccinia pruni-spinosae* Pers. and *Exoascus pruni* Fuck.

XXX) *Prunus cerasus* L. — *Taphrina muko* Sadl. in the districts of Aleksin and Bielew. *Clasterosporium carpophilum* Aderh. caused extensive damage in the government of Tula: reddish blotches appear on the leaves; they extend and join up, sometimes occupying a large portion of the surface of the leaf, the tissue of which dries and falls at the points attacked. This *Clasterosporium* also attacks fruits, the pulp of which is then rendered useless and partly dries away.

XXXI) *Ribes grossularia* L. — *Sphaerotheca mors-acae* Berk. and Curtis, and *Puccinia fringsheimiana* Kleb.

XXXII) *Ribes nigrum* L. — *Cronartium ribicola* Dietrich and *Septoria ribis* Desm.

XXXIII) *Ribes rubrum* L. — *Pseudopeziza ribis* Kleb.

XXXIV) *Fragaria* spp. — *Septoria fragariae* Desm., *Ramularia tusasnei* Sacc., *Marssonina potentillae* Fisch. subsp. *fragariae* Sacc.

XXXV) *Rubus idaeus* L. — *Phragmidium rubi-idaei* Winter and *Septoria rubi* West.

XXXVI) *Rosa* spp. — *Phragmidium subcorticium* Winter, *Sphaerotheca pannosa* Lev., *Actinonema rosae* Fr. and *Monochaetia depauperata* Otth.

XXXVII) *Paeonia officinalis* L. — *Cronartium asclepiadium* Friv.

XXXVIII) *Sorbus aucuparia* L. — *Gymnosporangium juniperinum* Winter and *Sclerotinia aucupariae* Ludw.

XXXIX) *Crataegus oxyacantha* L. — *Podosphaera oxyacanthae* D. B. and *Ascochyta crataegicola* Allesch.

XL) *Rhamnus frangula* L. — *Microsphaera alni* Winter var. *divaricata* Wallr. and *Puccinia cionata* Corda on a large scale in the forests of Novosil.

XLI) *Rhamnus cathartica* L. — *Puccinia coronifera* Kleb., *Ascochyta frangulina* Kab. and *Phyllosticta cathartici* Sacc. along the banks of the Oupa.

XLII) *Caragana arborescens* L. — *Uromyces genistae-tinctoriae* Winter; *Septoria caraganae* Henn.; *Phyllosticta spaethiana* Allesch. and *Ascochyta borjomi* Bond.

XLIII) *Conicera xylosteum* L. — *Leptothyrium periclymeni* Sacc.

XLIV) *Sambucus racemosa* L. — *Phyllosticta sambuci* Desm. and *Ascochyta syringae* Bres.

XLV) *Syringa vulgaris* L. — *Phyllosticta syringae* West., and *Ascochyta syringae* Bres.

XLVI) *Prunus padus* L. — *Exoascus pruni* Fuck.; *Pucciniastrum padi* Ditel and *Polystigma ochraceum* Sacc.

XLVII) *Pinus sylvestris* L. — *Lophodermium pinastri* Chev. wrought serious havoc among young 1-year old plants in the nurseries of Bogoroditzk.

XLVIII) *Pinus strobus* L. — *Cronartium ribicola* Dietr.

XI, IX) *Betula alba* L. — *Melampsorium betulinum* Kleb. in the nurseries of Bogoroditzk, destroyed a large number of young plants 2 or 3-years old; *Phyllactinia corylea* Karst. and *Sclerotinia betulae* Woron.

I.) *Fraxinus* spp. — *Fusicladium fraxini* Aderh.

II.) *Acer* spp. — *Uncinula aceris*; *Rhytisma acerinum* Fries; *Emmascus confusus* Jacz.; *Taphrina polyspora* Sorok.; *Phyllosticta aceris* Sacc.

II.) *Ulmus* spp. — *Phyllosticta lacerans* Pass.

III.) *Populus tremula* L. — *Melampsora populina* Jacz.; *Gloeosporium tremulae* Pass.; *Fusicladium radiosum* Lib.; *Asteroma populorum* Sacc.

IV.) *Populus* spp. — *Taphrina aurea* Fries.

IV.) *Salix* spp. — *Uncinula salicis* D. C., *Rhytisma salicinum* Fries, *Septoria santonenensis* Passer.

LV.) *Tilia europea* L. — *Gloeosporium tilliae* Oudem. broke out with unusual violence and caused withering and fall of the foliage in the spring; *Cercospora microsora* Sacc. attacked all the lime trees in several localities towards the second half of summer; *Asteroma tilliae* Rnd. and *Ectostroma tilliae* Fries.

LV.) *Quercus* spp. — *Oidium dubium* Jacz.; *Microstroma album* Sacc.; *Septoria dubia* Sacc.; *Phyllosticta quercicola* Oudem, and *Ascochyta dubia* Sacc.

689 - Behaviour of Different Forms of *Rhizoctonia violacea* (1). — ERIKSSON J. A. KÖR in *Arkiv för Botanik*, Vol. 14, Part 3, No. 12, pp. 1-31. Fig. 1-13. Stockholm, 1915.

Rhizoctonia medicaginis D. C. was first reported in Sweden in 1911 (in the island of Gothland) in a lucerne-field sown with seeds from Svalöf. Round the upper part of the root of the infested plants a violet-coloured mycelium develops, which may sometimes spread to the neighbouring parts of the stalk. The mycelial mass is not always of the same consistency: in some cases the hyphae form a loosely-woven texture, while in others they gather into a compact mass containing many sclerotia. These two forms of mycelium are clearly distinguished by the fact that perithecia only occur in the mycelia with loosely-woven hyphae. The perithecia are absent, on the other hand, when the hyphal tissue is very thick and provided with sclerotia. Their perithecia may be identified beyond all doubt with *Byssothecium circinans* (*Leptosphaeria circinans* Sacc.), a pyrenomyces discovered by Fuckel in 1861, and studied later by Prunet and Lăistner.

If *Leptosphaeria circinans* is in reality a stage in the development of *Rhizoctonia medicaginis*, any identity between the latter and the *Rhizoctonia* pest of heetroots is disposed of. *Rhizoctonia* infesting the beet in its per-

(1) See also *B.* March 1912 No. 574; *B.* April 1913, No. 426; *B.* July 1913 pp. 1035-37; *B.* Jan. 1916 No. 123.

thecial stage exhibits a distinct form - *Hypocynus violaceus* - which is a hymenomycete.

Rhizoctonia asparagi Fuck. attacks the rootstock of asparagus and kills the plant. In bad cases the parenchyma of the root cortex is quickly destroyed, and nothing but the central ground-tissue and the periderm remain. In the cavity thus laid open, a dark brown mycelium with very thin hyphae and black sclerotia develops. On the other hand, no trace of perithecia is observable, as they are unable to develop at the depth where the asparagus roots spread.

Similarly, *Rhizoctonia violacea* of beetroots, *R. solani* and *R. medicaginis* only develop their forms *Hypocynus violaceus*, *H. solani* and *Leptosphaeria circinans* towards the upper part of the root or at the base of the stalk.

Are *Rhizoctonia medicaginis* and *R. asparagi* identical? What biological relation exists between these two fungi and other kindred forms?

Two plats, separated from the surrounding land by an underground wall to a depth of one metre, one of which was infected with *Rhizoctonia medicaginis*, and the other with *R. asparagi*, were sown with lucerne, red clover, turnips, sugar beet and forage beet.

In the plat containing the germs of *R. medicaginis* the lucerne alone was attacked. In that containing germs of *R. asparagi*, asparagus alone was infested. In both cases all the other plants were unharmed.

The results obtained are in conflict with the opinion which has long obtained, namely that the forms of mycelium known together under the name of *Rhizoctonia violacea* are identical, assuming that *R. medicaginis* can be derived from *R. asparagi*.

The writer several times tried to graft the *Rhizoctonia* of the beet on lucerne roots; the results obtained were always negative or the forms were quite harmless.

It is of course not impossible that the parasite characteristic of a certain plant and peculiar to it, may be able to live on another plant as well and cause a milder form of disease, without losing its individuality to any extent. Thus, in 1886, Rostrup met with the *Rhizoctonia* of red clover not only on *Trifolium hybridum*, *T. repens*, *Medicago sativa* and *M. lupulina*, but also on *Rumex crispus*, *Geranium pusillum*, *Fagus sylvatica*, *Oxyacantha*, *Ligustrum vulgare*, *Picea alba*, *Abies pectinata*, *Pinus laricio* and *P. montana*. Each given form of *Rhizoctonia*, however, could only develop as a true parasite and pest on a given plant: that of lucerne on lucerne, that of the beet on the beet, etc. They have adapted themselves to such an extent, and reached such a stage of evolution, that each of these forms may be regarded as possessing the standing of a "species".

1909 - Relation of Stomatal Movement to Infection by *Cercospora beticola*.

— POOL VENUS W. and MORAV M. B. in *Journal of Agricultural Research*, Vol. V, No. 22, pp. 1011-1038, Fig. 1-6, Plates LXXXI-LXXXI, Washington, D. C., February 28, 1910.

The conidial germination tubes of *Cercospora beticola* Sacc. penetrate the stomata of the leaves of the sugar beet. They there develop a number of round cells in the chamber below the stomata, branching off towards

the cells of the parenchyma, and invading the intercellular spaces. The tissues of the host react and endeavour to isolate the infected parts by secreting special substances. This sometimes causes a stoppage of the pathological process, and the leaves continue to grow and develop regularly.

In the course of these experiments it was ascertained with certainty that the germ tubes can only enter through open stomata. Consequently, all conditions and factors promoting the opening of the stomata will have also a positive effect on inception of the infection. This, for instance, is true of the direct light of the sun, of rather high temperatures, of high relative humidity (never below 60%) and of leaf organs acting fully. In well developed green leaves the stomata remain open almost all day, while the recently formed young leaves usually close at about 3 p. m., and in old leaves the stomata move seldom and tardily. It is owing to these conditions that the infection usually appears on the finest and most vigorous leaves, while the mature and the tender leaves grouped towards the apex of the plant generally remain immune.

691 - Wintering of *Oidium* sp., a Pest of *Photinia serrulata* in Emilia, Italy. --

PUGLION V. in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, 1st Half-year, Part 5, pp. 340-342 Rome, March 5, 1916

By these observations it is sought to ascertain whether the species of *Oidium* first observed at Ferrara and later at Bologna as a pest of *Photinia serrulata* should be included among the forms which winter in the buds. The writer did not find the perithecial form of the parasite which, in the conidial form, exhibits great analogy with *O. farinosum* (living on the apple tree and related to *Podosphaera leucotricha*), which is well known to occur widely in Emilia, and which winters in the conidial form in the buds of its host.

In the spring of 1915, a number of buds were seen to open and put forth shoots, all of which were covered with a thick layer of mycelium and which stood out among the uninjured buds. Some time passed before blotches of *Oidium* appeared scattered sporadically over the leaves of the buds previously free, and probably coming from the conidia disseminated by the infested shoots. This is the same process as that observed in the mode of infection of the *Oidium* of the oak, apple and rose.

In 1916, owing to the mild season, the buds of *P. serrulata* were ready to put out shoots as early as the second or third week in February. Observation of some specimens showed a striking difference in development of buds in the same individual. Microscopical examination proved that the most advanced buds were healthy. The most backward ones, still unopened and poorly filled out, were all found to be infested with *Oidium* when cut. The mycelium covers the inside face of the protective scales with an abundance of conidiophores, but it attains its maximum development on the growing point and the rudimentary leaves. On forcing the plant in the incubator the shoots open out rapidly and are seen to be all infested in a characteristic way by the parasite.

This new example of wintering in the vegetative form, which must

be added to the many cases disclosed by the study of the Erysiphaceae, confirms the frequency in nature of close adaptation of the life cycle of the parasite to the vegetative conditions of the host. So frequently is this the case that it reduces the importance of the part played by evolved fructifications (perithecia, oospores and chlamydospores) as compared with the vegetative apparatus and the agamic fructifications, in relation to the preservation of the species during adverse seasons, or while the host is resting. These biological features, moreover, may furnish useful suggestions for practical methods of control.

602 - **The Life History of *Exoascus deformans* (Peach-leaf Curl) and Preventive Treatment.** - PEGLION V. in *La Stazione Sperimentale di Agricoltura, Padova*, Vol. XLIX, Parte 3-4, pp. 200-218, Modena, 1910.

The results are here set out of ten years' observations in Emilia, Italy, taking into account the studies published by other writers during that time.

Propagation of *Exoascus deformans*. - A) *Perennial mycelium.* According to Pierce ("Peach Leaf Curl: its Nature and Treatment", Bull. No. 20, U. S. Department of Agriculture, Veg. Path. and Phys., 1900) "it seems likely that the small twigs bearing deformations visible to the naked eye are the true and only focus of the perennial mycelium and everywhere form the sole source of spring infection due to the wintering hyphae, the only source of infection which is not reached by spraying."

The writer found that in Emilia, small twigs attacked while still young by *Exoascus*, as well as shoots infected at the time of opening of the bud, do not survive the winter; he never succeeded in finding the disease present as a hibernating mycelium in shoots entirely at rest. It follows that, from the practical point of view, the perennial mycelium of *Exoascus* plays an insignificant part in the preservation and propagation of the parasite either owing to the very limited number of foci of infection or to the fact that the infection due to the perennial mycelium is confined to the young shoots which undergo almost the same effect as when infected by the spores.

B) *Propagation by Ascospores.* - "As a single spraying suffices to prevent the disease in 90-98 per cent of the cases, it may be assumed that this percentage represents the infection produced by the spores". This deduction made by Pierce still remains hypothetical, as there is no direct confirmation and experimental demonstration of the process of infection.

All endeavours to solve this problem are rendered hopeless by the impossibility of inducing the growth of *E. deformans* in artificial media or studying it in combination with other fungi with which it is associated under natural conditions. The writers' trials were also negative in result. He had occasion to observe that *E. deformans* is a comparatively cold-loving organism, which is in keeping with the fact that the epidemic breaks out when sudden cold spells occur at the beginning of vegetation of the peach. Under the conditions existing in Emilia, periods of fog accompanied by abundant and persistent dew are chiefly to be feared.

Means of Control. When urgent action is called for, the writer advises the following comparatively concentrated solution, which is prompt

in action owing to the ammoniated copper remaining in solution, which on the evaporation of the ammonia, leaves behind a deposit of readily soluble oxyhydrate of copper. It is sufficiently adhesive and possesses remarkable reserve powers in the shape of copper compounds which act in succession. Ammonium chloride may be replaced by ammonium sulphate. The mixture has already been practically applied with good results:

	lbs
Sulphate of copper	2
Quicklime	1
Ammonium chloride	0.200
Water	100

Several Italian agricultural journals have suggested the use of solution with 3 or 4 per cent of sulphate of copper, but the writer thinks 2 per cent sufficient, it being more advantageous to repeat the sprayings during the period of rest than to increase their concentration.

In cases where, as happens in Romagna, the peach tree is attacked by *Diaspis pentagona*, as well as by *E. deformans*, the lime-copper solution should be replaced by lime-sulphur solution.

When spraying, the utmost care must be taken to reach all the buds, the operation must be done in good time, that is, before the flower buds begin to swell.

693. **Action of Copper Sulphate on Vine Mildew.** — SEMICHON in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 11, pp. 372-381. Paris, March 1910.

The final action of sulphate of copper is explained by two facts: 1) the surplus copper sulphate remaining on the leaves is partly soluble in atmospheric water, and when dissolved it kills the zoospores of the mildew, which have multiplied in consequence of the rain. According to MILLARDET, 2 or 3 tenths of a mgm of copper per litre are sufficient for that purpose. 2) a part of the copper is directly absorbed by the tissues, which are thus immunised.

The author proposed, by a series of experiments: 1) to elucidate the cause of the frequent and considerable variations observed in the length of time for which sulphate of copper remained effective after application; 2) to measure the action of the copper absorbed, at the same time studying the conditions under which absorption takes place.

Surplus Copper Sulphate. — The greater the length of time expired since application, the less is the quantity of soluble copper remaining. With a rainfall of 20 mm. the observations are:

	mm. of copper per litre
After 2 days	4.5
6	1.2
10	0.8
15	0.5
20	0.3

There has been much discussion as to the relative value of Bordeaux and Burgundy mixture, acid, neutral or basic preparations, plain solutions, copper and ammonia liquids, etc. without any account being taken of the most important factor, namely, the curve of insolubility of the deposits, ascertaining its variations according to the different composition and preparation of the mixtures. To secure good practical results the residue should not be too soluble, otherwise the first rain dissolves it and washes it away to a large extent. Again, it must not be too insoluble, as in that case even plentiful rain would not suffice to dissolve the quantity required for a fatal dose.

As already stated, two or three tenths of a milligram are sufficient, according to MILLARDET, to destroy the zoospores of the fungus, in reality, however, the quantity of copper needed increases with the number of zoospores, and in cases of very severe infection the Author detected live zoospores in solutions containing 2.8 mm. of copper per litre. Under given conditions, therefore, the action of the surplus sulphate comes to an end three or four days after the application. Under other circumstances again, i. e. when the number of zoospores is rather low, this action may last more than twenty days. This is the cause of the great variations observable in the length of time during which the surplus copper remains effective.

Copper absorbed: 1) When it has made its way in, the soluble copper can circulate through the tissues with the sap.

2) It has been observed that plain solutions of sulphate of copper often cause burns on the leaves, chiefly towards the edges, which turn black. These leaves contain absorbed copper and are immunised. Copper can therefore be absorbed as a result of tranlocation.

3) When a sudden fall in temperature stops the upward movement of the sap and the development of the foliage and branches in spring or summer, the plant passes into a period termed "period of receptivity". The tissues are at that moment particularly adapted for absorbing copper. Having measured the quantity of copper absorbed during a period of strong uninterrupted growth and a period of suspended activity, the writer found 16 mm. and 71 mm. per kilogram of foliage.

Practical Applications. — 1) The copper immunises the vine. It is serviceable above all in those cases where the action of surplus copper is inadequate.

2) In both cases soluble copper alone should be taken into consideration, as it is the only form acting against the zoospores and capable of absorption by the tissues, with resulting immunisation. These facts suggest the desirability of reverting to the use of plain solutions of sulphate of copper and powders containing soluble copper.

3) Better results would be obtained: a) by using liquids containing soluble copper instead of the mixtures in which the whole of the copper is precipitated in the form of flakes of hydrate or hydrocarbonate of copper; b) by spraying during the period of receptivity.

4) The use of powders containing soluble copper is particularly advisable in June and July, at the time when the dews are so favourable

to the growth of the mildew. The dew dissolves the copper, which acts directly against the zoospores and is even absorbed by the tissues.

5) It is well known that the mildew is propagated from year to year by means of the winter spores which form on the mosaic-like network of spots, characteristic of autumn attacks. The more virulent these spots the more serious would be the outbreak in spring. Hence the importance of a thorough autumn application of a simple solution of sulphate of copper which, being absorbed by the tissues, would arrest the function of the winter spores.

1904 - **A New Disease of Germinating Wheat caused by *Podosporiella* sp., in Salt Lake Valley.** — O'GARA P. J., in *Science*, New Series, Vol. XLII, No. 1079, pp. 313-315, Lancaster, Pa., 1915.

The writer, on visiting some areas of land under wheat in Salt Lake Valley (Utah) in 1915, was struck by the irregular growth of the young plants, some of which were stunted and defective. In the previous year, wheat had been infested in the same localities by the wheat-straw worm (*Isosoma grande* Riley), so that the first thought was to attribute the abnormal condition of the young plants to the action of the larvae of this parasite. A careful examination of the backward specimens, however, disclosed the presence of a fungus infesting the grains, partly destroying them and causing deterioration of their contents at the time of germination.

According to the writer, the pathogenic agent is a new species of the genus *Podosporiella*, which he proposes to study and describe at an early date.

1905 - ***Bacillus Sorghii* *Andropogon Sorghum* in Salt Lake Valley, Utah.** — O'GARA P. J. in *Science*, New Series, Vol. XLII, No. 1079, pp. 314-315, Lancaster, Pa., 1915.

The writer observed that some Sudan grass plants (*Andropogon sorghum*) recently imported into Utah, were infested with a bacterial disease due to *Bacillus sorghi* Burr.

On the leaves, elongated blisters are observed, ruddy brown in colour and very numerous, which cause the leaves attacked to wither and die.

In 1915, the outbreak of this disease was certainly due to the rains and persistent wet weather in the month of May. Normally it should not form a serious obstacle to the cultivation of this forage plant.

1906 - **Sweet Potato Diseases in the United States.** — HARTER L. J., in *United States Department of Agriculture, Farmer's Bulletin* 714, 26 pp., 21 Fig. Washington, D. C., March 11, 1916.

In addition to many large centres in the South of the United States where sweet potatoes form the principal market crop, the industry has been intensely developed in one or two sections in the States of New Jersey, Delaware, Ohio, Illinois, Iowa and Kansas. This industry could be very much extended if the grower experienced no difficulty in storing the potatoes until the winter, when they fetch a much higher price. The trouble, however, is not only to find good methods of storage. The sweet potato is

attacked in the field by various fungus diseases, the principal of which are : black rot (*Sphaeronema fimbriatum*), stem rot (*Fusarium Batatas* and *F. hyperoxysporum*) (1) and foot rot (*Plenodomus destruens*) (2). The first of these diseases occasions heavy losses even in storage, where it rapidly develops. The second does not itself cause large storage losses, but may pave the way for other organisms producing rot.

A description is given of the different diseases attacking the sweet potato both in the field and in storage, with advice on the methods of control so far as known at present. These diseases and control methods are as follows :

Diseases of the Roots and Stems. — Stem rot (*Fusarium Batatas* and *F. hyperoxysporum*). — The seed potatoes should be disinfected by treating for 5 to 10 minutes in a solution made by dissolving 1 ounce of corrosive sublimate in 8 gallons of water. The hotbeds should be disinfected with a solution of formaldehyde or sulphate of copper, and the soil for the hotbed obtained from some place where sweet potatoes have never been grown. The farm utensils should be sterilised, healthy seeds used, and suitable crop rotations applied. The same means are used for controlling black rot (*Sphaeronema fimbriatum*), foot-rot (*Plenodomus destruens*), scum (*Monilochaetes infusans*) (3), (a very widespread disease attacking all varieties of sweet potatoes, and promoted by moist earth rich in organic matter), and root rot (*Ozonium omnivorum*), which attacks many plants both cultivated and wild : against this last disease deep and clean cultivation and aeration of the soil are important.

Leaf Diseases. — Leaf-blight (*Phyllosticta Batatas*), leaf-spot (*Septoria bataticola*) and white-rust (*Albugo Ipa-masac-pandurana*) (4), though occurring widely in the Southern States of the Union, have never caused such damage as to compel control measures.

Storage diseases of sweet potatoes are (in the order of their injuriousness) : soft-rot and ring-rot (*Rhizopus nigricans*) ; black rot (*Sphaeronema fimbriatum*) ; dry-rot (*Diaporthe Batatas*) (5) ; Java black rot (*Diplodia tubericola*) ; and charcoal rot (*Sclerotium bataticola*). To prevent them, the tubers must be lifted as late as possible but before frosts, taking care not to injure them. The writer advises that they should be well dried in the field, and hauled to the storage house in open crates holding about a bushel, leaving them in the crate for storage. The storage house must be kept at a temperature of 80 to 85° F. during the first days of storage in order to help to drive off surface moisture ; it is then gradually lowered to about 50 to 55° Fahrenheit and maintained at this during the storage period. It is also essential to keep the storage house dry and well aired. Before storing

- (1) See also *It.* July 1904, No. 657.
 (2) " " May 1904, 372.
 (3) " " May 1906, 585.
 (4) " " Sept. 1905, 135.
 (5) " " May 1906, 574.

the new crop the storage house must be disinfected with a solution of formalin or sulphate of copper or winter-strength lime sulphur solution, or by whitewashing.

697 - **Soilstain or Scurf (*Monilochaetes infuscans*) of the Sweet Potato** (1). -- TAUBENHAUS J. J. in *Journal of Agricultural Research*, Vol. V. No. 21, pp. 995-1001, Pl. LXXVII, Washington, D. C., February 21, 1916

Results of a series of investigations during a period of 3 years, in Delaware, in relation to disease of the underground parts of the sweet potato (*Ipomoea Batatas*) commonly called "soilstain" or "scurf".

The fungus causing the disease, *Monilochaetes infuscans* E. et H., may influence not only the quality but also the quantity of the crop, by attacking the rootlets of the plant and preventing normal growth of the latter. The resulting loss may amount to as much as 10 %.

After numerous unsuccessful endeavours, the pathogenic agent was isolated, and was found not to begin to grow in culture-media until after 3 weeks. This tardiness of development explains the difficulties encountered in identifying the organism and isolating it from the abundant flora and very varied micro-organisms, which over-run and conceal everything.

The fungus in question will also grow on sugar and starch media. There it is not these substances which, as was hitherto believed, prevent the pathogenic agent from penetrating the tissues under the epidermis; the inhibitory action must certainly be attributed to special enzymes secreted by the host.

The Author undertook a number of experiments with the object of studying the disease in tubers under storage; he arrived at the following conclusions:

- 1) Really healthy roots continue healthy even when originating from infected fields;
- 2) On the other hand, in slightly infected roots, the disease takes its normal course; the small spots spread and unite;
- 3) The diseased roots dry and shrink very rapidly;
- 4) Healthy roots can contract the disease if brought into contact with infected substances;
- 5) The development of the disease is promoted by storage of the roots in damp, badly ventilated places.

With regard to the morphology, it is found that the conidial spores are borne above the mycelium, the oldest part of which also becomes dark in hue. The conidia form in chains which break off as soon as moistened or disturbed.

698 - **Phytophthora Disease of Ginseng.** -- ROSENBAUM JOSEPH in *Cornell University Agricultural Experiment Station of the New York College of Agriculture, Bulletin* No. 363, pp. 65-106, Figs. 2-18. Ithaca, New York, 1915.

The American ginseng, *Panax quinquefolium* L., was brought under cultivation about 20 years ago but either the same or a closely related species

(1) See also B. May 1916, No. 580.

has been cultivated in Korea for more than two centuries. Three factors are favourable to its growth, namely, shade, good drainage and an acid soil. The failure of the grower to take these factors into consideration is primarily responsible for most of his losses with this crop.

The Phytophthora disease of ginseng (*Phytophthora Cactorum* [Cohn and Lebl] Schröt) probably exists in every State in which ginseng is grown.

Washington, Oregon, Nebraska, Kansas, Minnesota, Missouri, Arkansas, Wisconsin, Michigan, Indiana, Ohio, New York, Pennsylvania, New Jersey and Maryland. It also causes a large amount of damage in Japan.

The symptoms of the disease are as follows: Usually there is a drooping of a single one or all of the leaflets at the top of the petiole. In many cases the disease attacks the main stem at the crown, or point where the leaf petioles are attached, and all the leaves droop and hang limp from the top of the stem.

The leaf blades show dark green, water soaked spots. A week or two after the first appearance of the spot, the centre becomes white, the margins remaining a dark green. The spots vary in size from one centimeter in diameter to lesions involving the entire leaf. If the weather is wet and cloudy the disease spread rapidly down the stem, hollowing it out. The roots may also be attacked, showing a semi-soft rot.

In certain cases the disease starts by attacking the roots, subsequently spreading to the stem and leaves which turn yellow or brown. These symptoms, however, are common to several other diseases of ginseng, e. g. those due to *Alternaria panax* Whetzel (1), *Sclerotinia libertiana* Fekl., *S. panax* Rankin, *Acrostagmus* sp., *Fusarium* sp. Microscopical examination is therefore necessary for definite identification.

The writer's researches were concerned with the following: isolation of the fungus, various inoculation experiments with the mycelium, conidia and oospores in the stem or roots (positive results were obtained throughout), the comparative examination of *Phyt. Cactorum* isolated from ginseng with that isolated from *Phyllocactus* (the author concludes that the species are identical but considerable variations may be exhibited); the life cycle, the morphology of the fungus.

The methods of control are as follows:

(1) Spraying with Bordeaux mixture (3,3,50), to which has been added 2 lbs. of arsenate of lead for every 50 galls. of mixture. The fungicide should be applied as soon as the plants are pushing through the soil, and the application should be continued at intervals until all the plants have made their appearance. Spraying after this period will depend on weather conditions and on the amount of growth that the plants have made since the last application. Spraying should be done before rainy periods, and all the new growth should be covered.

(2) Removal of diseased parts.

(3) Deep planting, in such a way that the roots are at least 4 inches below the surface of the soil.

(1) See also B. Feb. 1916, No. 218.

(4) Rotation with crops immune from *Phytophthora* and which require the same conditions of shade. "Golden seal" (*Hydrastis canadensis*) is a good plan for the purpose.

(5) Soil sterilisation by means of steam under a pressure of from 7 to 100 lbs. for a period of time varying from 20 to 40 minutes, according to nature of soil.

(b) Drainage.

Appended to the paper is a list of 20 publications.

699 - ***Thielavia basicola*, a new Pest of the Melon in Salt Lake Valley, Utah.**

O' GARA, P. J. in *Science*, New Series, Vol. XLII, No. 1079, p. 311, Lancaster, Pa., 1913.

In 1915, in Salt Lake Valley, all the plants of a field of melons (*Citrullus vulgaris* Schrad.) perished, and a second plantation also suffered enormously. Many plants which had started to grow in an apparently normal way, withered and dried away after a time. Such few as did attain any development were stunted and chlorotic in appearance. On examining these the writer found that the root-stock had been destroyed; lateral rootlets had formed subsequently above the point attacked.

The diseased tissues were infested with the fungus *Thielavia basicola* (B. et Br.) Zopf, which was successfully isolated in pure cultures and produced its characteristic fructifications. This is said to be the first time the melon has been included among the hosts of this member of the Perisporiaceae.

700 - **An *Oidium* Mildew on Carnations, in England.** MERCER W. B., in *The Journal of the Royal Horticultural Society*, Vol. XL, Part 2, pp. 227-229, Fig. 86, London, 1915.

Description of a disease which suddenly broke out in the greenhouses of a garden in the Tyne valley in the early summer of 1914. It is due to an unidentified member of the Erysiphaceae. On the leaves and sepals patches of white mould appear, which gradually spread and eventually assume a yellowish hue. The mycelium forms a web of threads over the surface of the infected parts and whose branches are closely applied to the epidermal wall. The haustoria, which are fine and thread-like, bore their way through the cuticle and penetrate into an epidermal cell, where they become greatly distended, the cell cavity in some cases being almost entirely filled. "Lady Alington", "Bridesmaid" and "British Triumph" are the varieties which suffered most from this fungus. The parasite produces long, colourless chains of conidia, which break off and spread with great facility, propagating the disease. Owing to the absence of perithecia the species could not be identified.

The following mixture gave excellent results: 1 ¼ lb. crystallized copper sulphate, 1 quart of strong ammonia, 2 ½ gallons of water. Half a pint of this mixture diluted to 4 gallons with water before use.

Pleospora Briosiana, *Phomopsis Cocculi*, *Macrophoma Yuccae* and *M. Cinnamomi-glanduliferi*, new Micromycetes discovered in Liguria, Italy. — MOTTI LUGI in *Rivista di Micologia e Patologia Vegetale*, 1915, 10, 2, 159-171. (Società Italiana di Micologia, Roma.) Vol. XXI, 1915, Bologna, Italia, 1915.

Continuing his investigations on the mycology of Liguria, the writer describes the following four new species:

1) *Pleospora Briosiana* n. sp. was observed in 1915 at Chiavari, when it attacks the foliage of *Bignonia latifolia*, producing blotches of irregular shape. In many leaves the infection starts at the apex and spreads towards the base, involving a large area of leaf. In others it is confined to the edges but is still of some extent. The blotches are hazel coloured, with black borders shading off.

2) *Phomopsis Cocculi* n. sp. was likewise met with at Chiavari in 1915. The leaves of *Cocculus laurifolius* attacked by this micrococcete show light ashy spots, irregularly bordered with black, shaded with hazel. The spots usually occur at the end of the leaf, involving about one third of the latter. On the spots the fructifications of the fungus are observable, which develop on both faces.

3) *Macrophoma Yuccae* n. sp. was observed in 1915 at Nervi on foliage of *Yucca gloriosa*. The fructifications develop within ill defined patches surrounded with a dark border.

4) *M. Cinnamomi-glanduliferi* n. sp. was discovered in 1915 at Chiavari and Sarzana on leaves of *Cinnamomum glanduliferum*. It forms large hazel blotches, more or less pronounced, with a border of darker colour. The attack of the parasite reduced the majority of the infested plants to a wretched condition.

702. **Brown Rot (*Sclerotinia cinerea*) of Prunes and Cherries in the North-West Region of the United States**. — BROOKS CHARTER and FISHBE, in *United States Department of Agriculture, Bulletin No. 702*, p. 1-17, Pl. I-III. Washington, D. C., March 9, 1910.

For several years the growers of the Lower Columbia and Willamette Valleys have had severe losses of their prunes and cherries, owing to the dropping of the bloom and young fruit. Mr. M. B. WATTS, Pathologist in charge of Fruit-Disease Investigations (Dept. of Agriculture, U. S. A.) examined some diseased prune blossoms sent him, and found them to be infected with the ordinary brown rot fungus (*Sclerotinia cinerea* (Desm. Wor.), the conidial form of which (*Monilia*) had attacked the bloom in various stages, killing some of the buds before they had opened, often penetrating the entire flower and extending down the pedicel. Some of the blossoms had set their fruit, and the young prune had started to develop before the flower was completely killed. In other cases the young fruit were penetrated. In others again they were not yet penetrated by the fungus, which had partly killed the flower and spread down the pedicel. The conidial form of the fungus was fruiting abundantly over most of the surface of the diseased organs.

(1) See also B. August 1914, No. 722.

In 1915 the study of the disease was continued at Vancouver, Washington, with the following results:

In some years the brown rot problem is one of great importance to the prune industry in the more humid sections of the North-West of the United States. It has been shown that the apothecia which developed from fallen prunes are the probable source of the blossom infection. The appearance of the apothecia and infection of the former are simultaneous. The conical form has never been found on fallen fruit. Autumn ploughing and early spring cultivation, ahead of the blossoming period, have apparently helped to prevent the disease by interfering with the development of the apothecia. The wind is probably the most important agent in spreading the spores. Insects may be concerned in this distribution, but are chiefly important owing to the punctures they produce on the fruit, furnishing an entrance point for the fungus. Among the insects, the fruit tree leaf syneta (*Syneta albida* Leconte) is probably of importance, as it was present in great numbers during the early part of the season, feeding on both fruit and foliage and causing much damage.

Though the early applications of spraying were washed off, showing the importance of adding a sticker, even with rather unsatisfactory conditions, spraying has given fairly good results. The plats given both early and late spraying with self-boiled lime-sulphur set from 1 to 5 times as much fruit as unsprayed ones, gave 2 $\frac{1}{2}$ times as large a yield and had only $\frac{1}{10}$ of the total brown rot on the harvested and $\frac{1}{4}$ on the stored prunes. Self-boiled lime-sulphur and Bordeaux mixture have both given good results, but the former has seemed somewhat more satisfactory.

The sticking and spreading qualities are greatly improved by the addition of 2 pounds of resin fish oil soap to each 50 gallons of mixture. On the basis of experience up to the present time the following schedule of spraying may be suggested:

The first application just before the blossoms opened, the second just after the petals have fallen, a third 3 to 4 weeks later, a fourth about 2 weeks before harvesting. In 1915 the first and fourth sprayings were particularly important.

Observations made near Vancouver, Washington, and in the vicinity of Salem (Oregon) in the spring of 1915 showed that there had also been a blossom infection of cherries. Spraying trials were made (on the 7th and 8th May and 1st June) with Bordeaux mixture and lime-sulphur solution with or without resin fish oil soap. Part of the fruit from each plan was packed and placed in cold storage, being afterwards shipped. The trial were begun too late to be of any decisive value. They nevertheless prove that late spraying with Bordeaux mixture or self-boiled lime-sulphur greatly reduces the loss of stored fruit. Probably a similar treatment to that of prune trees applied to the cherry trees would effectively control the infection both of the blossoms and fruits.

93 - An Asiatic Species of *Gymnosporangium*, established in Oregon.

JACKSON H. S., in *Journal of Agricultural Research*, Vol. V, No. 22, pp. 100-106, Pl. LXXVIII-LXXIX. Washington, D. C., February 28, 1916.

In June 1914, the Author observed, at Orient, in the environs of Portland, Oregon, two Japanese pear trees (*Pirus sinensis*) the foliage of which was seriously infected with a species of *Roestelia koraensis*.

So far as known, all species of *Roestelia* are the aecidial stages of species of *Gymnosporangium*.

In March 1915, in the above locality, within twenty feet of the two Japanese pear trees, the Author found some specimens of *Juniperus chinensis* with foliage abundantly infected with the telial stage of *Gymnosporangium* which was identified as *G. Haraeum* (= *G. koraense*).

With branches of infected juniper the Author communicated the disease artificially to potted specimens of *P. sinensis* and *Cydonia vulgaris*. The ecidia collected from *P. sinensis* and *C. vulgaris* agreed in all respects with *G. koraensis*.

Little is known concerning the economic status of this fungus. Other species of *Gymnosporangium* already established in America caused considerable damage, for instance *G. Juniperi-virginianae* Schw. in the eastern States and *G. Blasdalcannum* (D. et H.) Kern in the Pacific States.

The aecidial form of the *G. Haraeum*, as stated, develops on *P. sinensis* and *C. vulgaris*, but very probably it might spread to other species of rosaceous trees, just as *G. Haraeum* might at any time find a favourable environment in the American species of juniper, and thus become definitely established in America.

WEEDS AND PARASITIC FLOWERING PLANTS

94 - Investigations in 1914, on the Weeds occurring in the Government of Kherson, Russia. - PACZOSKY I. in *Trudy Bopu an upokulturnu Bommarsk* (Studies of the Bureau of Applied Botany), Year VIII, Vol. 6, 1905, pp. 816-820. Petrograd, 1915.

The Bureau of Applied Botany attached to the Ministry of Agriculture undertook: (1) to devise a method for the study of field weeds; (2) to study the root system of the weeds peculiar to the region.

A field of 600 sq. metres sown with oats and infested with wild oats was divided into 1206 equal parts (6.44 sq. ft. each) and the culms of the two plants in each were counted. The actual average of weeds was found to be equal to 17.15 culms per sq. ft.

A determination of the average based on various combinations of the number of plots (i. e. taking every fifth, every tenth, every twentieth, etc.) only furnishes results close to the real average when the number of plots is very large, which renders the method impracticable. Therefore the writer holds the view that the only practical method for determining the degree

1 (1) See also *B. Moy* 1914, No. 481.

to which a field is infested with weeds is to confine oneself to one or a few selected plots, after very careful observations of the actual conditions in the field.

With regard to the root system, it has been found that the roots of *Cirsium arvense* reach a depth of 20 ft; those of *Euphorbia rigata*, 9.84 ft; of *E. glariosa*, 8.53 ft; of *Centaurea scabiosa* and *Salvia nemorosa*, 7.22 ft; of *Reseda lutea* 9.18 ft and of *Melandrium album* 6.9 ft. It has also been observed that some weeds gain fresh vigour in consequence of cultivation (*Reseda lutea* and *Melandrium album*).

705 - Experiments for Control of *Ranunculus arvensis*, a Weed infesting Wheat, in Touraine. - MARTIN J. B. in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. II, No. 13, pp. 429-424. Paris, March 1916.

Ranunculus arvensis (known in Touraine as "picot", "pied-court" or "pied coq") is one of the most injurious weeds of autumn wheat. It presents little danger in shallow, warm, sandy or limey soils, but is a redoubtable pest in the clayey soils of Touraine. In strong, cold soils, during wet winters, it can thrust its roots deep down and strengthen its stem and the wheat, hindered by the excessive moisture in the soil, and depending for its development on the return of good weather, is choked by it. In 1911 and 1912 the writer observed wheat in the commune of Saint-Branches which had been overrun and weakened to such an extent by the *Ranunculus* that it had to be cut green for forage.

The writer carried out control experiments, with results as follows:

1) Sulphate of copper, used alone, in the proportion of 4 $\frac{1}{2}$ lbs. to 10 gallons of water, produced burns but did not kill the weed.

2) Sulphate of copper (9.9 lbs.) and nitrate of soda (22 lbs.) to 10 gallons of water killed or seriously injured 35% to 40% of the weeds and the wheat, strengthened by the nitrate, gained the upper hand.

3) Anhydrous sulphate of iron, at the rate of 624 lbs. per acre gave the best result. More than 80% of the weeds were destroyed entirely. It is advised that this remedy should be applied at the beginning of February.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

706 - Two new British Coccidae and other British Species Injurious to Plants.

GREEN ERNEST E. in *The Entomologist's Monthly Magazine*, Third Series, No. 1 (No. 629), pp. 23-24, Fig. 1 and No. 14 (No. 631), pp. 25-31, Fig. 2-4. London, January and February 1916.

A list of some coccids found in England, two of which are described as new species.

Parafairmairia gracilis, n. sp., on the leaves of various grasses and sedges at Camberley (Surrey).

Lecanopsis longicornis, n. sp. 3 specimens found on plots of grass at Camberley, July 1915.

Gossyparia ulmi Geoffroy, on a Cornish elm at Farnham (Surrey).

♂ *Aspidiotus hederae* Vallot, a common greenhouse pest throughout the British Isles, infesting more particularly various kinds of palms (*Dracaena citrus* and oleander. It was also found in the open in April 1913 on the foliage of *Aucuba japonica* at Torquay.

Aspidiotus ostraciformis Curt., found on the branches and stems of young poplars at Farnham. May be readily mistaken for *A. tricus aspidiotus*, described by MARLATT, from material "on old dried poplar bark from Transcasian Russia".

Mytilaspis ficus Sign., on young twigs of edible fig at Wisley (Surrey).

Parlatoria pergandei Const., on branches of Japanese maple in L. garden.

Parlatoria proteus Curtis, on plants of *Fuchsia* sp., at Wisley.

Lecanium ciliatum Douglas, previously recorded in Devonshire, Cheshire and Kent; Camberley in Surrey now added.

Lecanium persicae Geoffroy, on leaves of *Alnus*.

Eriopeltis festucae Fonsc.

Luzulaspis luzulae Duf.

Pseudococcus walkeri Newst., found rather commonly in the Camberley district.

Pseudococcus sp. (possibly *Ps. citri*), on a window pane at Torquay.

307. ***Prospaltella berleset* against *Diaspis pentagona* in Piedmont in 1915** (1). — VOGELIO P. in *R. Osservatorio di Entomologia Agricola, Bollettino del Direttore*, 16 pp. Turin, 1916.

In December 1913, the "Associazione serica e filologica del Piemonte", in concert with various agricultural organisations and by the aid of special subsidies from the Ministry of Agriculture, Industry and Commerce, entrusted the Plant Diseases "Observatory" of Turin (assisted by the Travelling Lecturers in Agriculture) with the task of controlling *Diaspis pentagona* by means either of chemical remedies, or of *Prospaltella berleset*. The report of the Director of the "Observatory" sets out the result of this second part of the investigations in 1915. In the spring of that year the "Observatory" distributed 304 700 branches of mulberry covered with *Prospaltella* derived from Casale Monferrato, Rosta, Lucente, Cigliano, Lombriasco, Rivoli, Asti, Pianezza, Beinasco, Stupinigi, and Azeglio, these having been found the most suitable of all the centres examined for the supply of material.

The writer sets out in detail the observations made and the results secured in each of the localities, arriving at the following conclusion:

1) The mulberry, in 1915, thrived almost everywhere in Piedmont, without any trace of attacks by *Diaspis*.

2) *Prospaltella* is found in Piedmont in abundance, stopping or limiting the infestation of the mulberry tree in a great many places.

3) In some centres plentifully provided with *Prospaltella* contamination was maintained in some groups of mulberries and was introduced on others. Vegetation however continued to be regular and vigorous everywhere, thanks to the immediate intervention of *Prospaltella*.

(1) See B. April 1915, No. 452.

4) In very wet localities, where *Diaspis* encounters conditions highly favourable to its existence and spread, the beneficial effect of *Prospaltella* was observed almost everywhere, maintaining the mulberry in an almost normal state of vigour.

5) *Diaspis* multiplied with facility on certain pruned mulberries and on these the action of *Prospaltella* was generally found less effective.

6) *Prospaltella* does not spread in such a manner as to put a stop in a short time to the attack of *Diaspis*; in some regions, as in the province of Cuneo, it is necessary to further its dissemination by artificial means.

7) In the provinces of Turin, Cuneo, Novara and Alessandria there are at present numerous and extensive breeding centres with *Prospaltella* in process of development. These centres have already been brought by the staff of the Observatory to the notice of farmers of the region, offices, agricultural Associations, or managers of silk reeling factories, or will be brought under their notice on a following visit in due course. These centres will be able to supply farmers with material for distribution on the spot or also for despatch to a distance in accordance with the rules which will be laid down by the Observatory.

8) In order to enable *Prospaltella* to exercise its beneficial influence on the mulberries it is essential that normal pruning should be carried out every 2 to 4 years or at any rate cutting of branches on a rational system with short period of rotation.

9) A very active destroyer of the *Diaspis* was found everywhere in *Chilocorus bipustulatus*.

10) The farmer should not take alarm if, notwithstanding an abundant dissemination of *Prospaltella*, *Diaspis* reappears on an occasional mulberry tree. The *Prospaltella* is ready to oviposit on the new *Diaspis*, but where the insect has been distributed the branches must never be cut before the month of March; these branches must be left bound together in bundles in the field or on the trees.

11) With regard to the peach and various ornamental trees attacked by *Diaspis*, even when a thorough distribution of the insect has been made careful winter cleaning of the trunks and branches must not be omitted.

708 - **The Life History and Control of the Vine-Moths *Conchylis ambiguella* and *Polychrosis botrana*: Observations made 11n 914, by the Plant Diseases Observatory of Turin, Italy** (1). -- VOGLINO P. in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Year XIV, Vol. II, Series B, Part 1-2, pp. 21-38. Rome, 1915.

In 1914 the observations on the life history of the Vine Moths *Conchylis* and *Polychrosis* begun in the previous year were continued (2). The investigations in 1914 chiefly aimed at clearing up the life history of *Conchylis ambiguella*, while in 1913 the development of *Polychrosis botrana* had been followed up in particular. Various information was also gained

(1) See also B. June 1915, No. 665.

(2) " B. June 1914, No. 590.

About the latter species, which is undoubtedly the more injurious to the vine-growing regions of Piedmont.

Several Stations were installed in the different vine growing localities of Piedmont: each Station consisted of a large cage 7 ft. 10 inches by 3 ft 11 ins. and 7 ft 9 ins. in height, made of wire gauze with meshes of 2 mm. sustained by massive wooden frames. Each cage surrounded one or two vines, and was provided with a maximum and minimum thermometer, a barometer and a hygrometer. Observations were also made here and there by means of small special cages covered with wire gauze. The material gathered at each Station was forwarded periodically to the Observatory of Turin where it was studied.

From the investigations, which are described in detail, the following conclusions have been drawn:

1) In 1914 infestation by the vine moths was very limited almost everywhere as regards the spring generation, but was slightly more pronounced in the case of *Conchylis* than in that of *Polychrosis* in Stations with rather low temperature, while in the vine-growing regions of Astigiano and Monferrato *Polychrosis botrana* multiplied rapidly, especially the summer generation.

Some observers noted the appearance of the 3rd generation during or after the grape harvest.

2) The life cycle of *Conchylis* and *Polychrosis* did not differ very much from that of 1913 in reference to changes of temperature and moisture except that the hatching period of the summer moths was prolonged and for purposes of control it was found necessary to procure accurate data as to the beginning of hatching and the duration of the flying period.

3) The use of large cages is not always successful: disease chiefly due to *Botrytis* greatly reduced the larvae in the cages, and generally vegetation was tardy and irregular.

4) The small cages suspended to the vine props, in the rows, were found much more practical. This is the only means by which the vine-grower can be accustomed to keep a watch for the appearance of the moths and their maximum flight in his vineyard, in order to apply treatment.

5) In addition to a few species of arachnids and some fungi (chiefly *Botrytis*), the larvae and the adults of *Coccinella 7-punctata* were observed to prey effectively on the larvae of the above insects.

6) The use of a 2 % nicotine solution gave good results in some localities; nevertheless in almost all cases it produced more or less marked burns. The first treatment must be applied, if possible, before the flowers open, to avoid injurious burns of the latter.

7) Tobacco extract (2%) gave good results against the 2nd generation, preventing the passage of the larvae from one grape to the other.

8) The most effective remedy against the larvae of the 1st generation is arsenate of lead mixed with Bordeaux mixture in the proportion of 1 % . It must not, however, be used against the larvae of the 2nd generation, because then the grapes are about to ripen and poisoning may occur. The Observatory still hesitates even to advise the use of arsenate against

the first generation owing to its poisonous properties, more particularly as a 2% solution of tobacco extract, mixed with carbonate of soda or Bordeaux mixture gives good results when spraying is done at the proper time with powerful jet pumps.

9) The experience of two years of study proves that to obtain good results with 2% tobacco extract, two sprayings are required (both against the 1st and the 2nd generation), one shortly after the adults begin to emerge and the second in the period of maximum flight.

If the tobacco extract has proved unsuccessful, this must generally be put down either to the fact that the sprayings were not always carried out at the right time, i. e. coinciding with the two above moments of biological development, or to faults in the apparatus.

10) The Observatory therefore gives the preference to tobacco extract. This remedy at present has two drawbacks: 1) its content of nicotine not being constant, it produces burns on the vegetable tissue; 2) it is put on the market at too high a price. When these two drawbacks have been rectified, the farmer will have a fairly reliable means for controlling these insects.

11) When arsenate of lead is to be used against the first generation, none of the precautions taken in handling poisonous substances should be neglected. The operator must wear gloves made of good skin and cover his face with a mask with glass discs let in for the eyes.

12) It was also found in 1914 that cleaning the branches in winter, destroying the tips of the canes (used as vine props) and the stubble between the lines, greatly reduced the infestation.

The substitution of stone and ferro-concrete supports, connected by galvanised iron wires, for wooden vine props, always gave excellent results.

The pieces of rag attached at the points of bifurcation of the branches acted as very effective collectors of pupae.

709. **Tobacco Juice for the Treatment of the Vine-Moths *Polychrosis bostrana* and *Conchylis ambigua*, in Piedmont (1).**—TOPI MARTO, in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series 5, pp. 349-353. Rome, March 5, 1916.

Treatment with tobacco juice of 2% strength was applied at a vineyard situated on a hill with an eastern aspect, at Alice Bel Colle. There were six adjoining rows in the lowest part of the vineyard where the grapes had remained very abundant in spite of serious attacks of mildew. Each row treated contains about 70 vine stocks in full bearing, their distances in the rows being 1 ft 7 1/2 ins. to 3 ft 3 ins., and that between the rows 9 ft 9 ins. on the average. The varieties of vine cultivated are mixed: "barbera", "dolcetto", "lambrusca", "malaga" and some others.

There were two applications of tobacco extract, the first on the 21st July and the second on the 28th July 1915.

At the time of the first application, the eggs of the two lepidoptera

(1) See also *ib.* June 1915, No. 664.

were present on the grapes in abundance; in some bunches each grape bore eggs, either hatched or still to hatch. 3 or 4 were sometimes found on a single grape, and some were seen even on the grapes attacked by the mildew and already withered.

The eggs were in all stages, from those recently deposited to those in which the head of the larva could be distinguished, or which were about to hatch. In the lowest rows, moreover, hatched eggs and larvae which had entered the grapes were seen. It was here observable that the larva had not pierced the grape directly below the egg, but had travelled round it and made its entry at another point.

At the time of the second treatment the unhatched eggs were still very numerous.

On the 25th August the writer gathered the grapes injured and attacked by the two insects, which were found in the bunches of four vines, two treated, two untreated, one "dolcetto", and the other "barbera".

The following table contains the results of the examination.

Variety	Grapes injured or destroyed		Number of larvae found					
	Treated vine	Un-treated vine	in treated vines			in untreated vine		
			<i>Polych.</i>	<i>Conchylis</i>	Totals	<i>Polych.</i>	<i>Conchylis</i>	Totals
Barbera	260	590	16	14	30	100	4	104
Dolcetto	493	526	53	64	117	109	50	159
Total	663	1086	69	78	147	209	54	263

On examining the "dolcetto" grapes the fully developed larvae of *Polychrosis* and *Conchylis* are seen to abound. A large number had probably already penetrated the grape at the time of the first treatment. It should also be noted that the larvae of *Conchylis* are found in far greater number on the "dolcetto" than on the "barbera", although the stocks of the latter variety stand in the same rows as the former. There is nothing as yet to show whether this is due to a preference on the part of the *Conchylis* for that stock, or whether it arises from the earliness of the "dolcetto" as compared with the "barbera", or the precocious development of the *Conchylis* as compared with the *Polychrosis*, already repeatedly recorded. It follows that the effect of the treatment differed according as the first or second variety was in question. The applications were made in good time to the "barbera", but should have been made earlier to the "dolcetto". This difference in behaviour is another reason for keeping to a single variety of stock for each plot of land in new plantations. Control treatment would thus be rendered easier and more effective. If *Conchylis* pre-

dominates over *Polychrosis* in the locality, it would also be as well to apply the treatment some days earlier.

On examining the grapes of "barbera" treated with tobacco extract, it is observed that many of them are only slightly and superficially attacked. On the other hand, the percentage completely spoilt on seriously attacked is much higher in the untreated "barbera" grape. While in the treated grape only one larva is found to 8 or 10 grapes attacked, on the untreated stock the proportion is one to every 3 or 4.

The results therefore were to reduce by about 50 % the number of grapes completely or partially spoilt (the fact of lesser injury to the grapes should be taken into account) and the reduction by this same figure found in the number of larvae. These results obtained with two summer treatments only should promise well for more effective control of the two lepidoptera by winter working and spring and summer treatment.

710 **Method of Cockchafer Control used in Germany.**—FISCHERICH K. in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 134-156. Berlin, March 1916.

An account is given of the extensive experiments for the control of the cockchafer (*Melolontha vulgaris* and *M. hippocastani*) carried out in the "Bienwald" in the Upper Palatinate. This State forest, which covers an area of several thousand acres, has for many years been invaded by multitudes of cockchafers, sometimes occasioning widespread damage. It is made up of conifers (*Pinus*, larch and Weymouth pine) and deciduous trees (beech and oak). The comparatively dry, sandy and stony soil, forming dunes, is favourable to the multiplication of the cockchafer, the development of which has also been fostered by the very mild winter climate and, up till a few years ago, also by bad methods of forestry.

Cockchafer control was taken in hand as far back as 1882, but without satisfactory results.

Seventeen years experience of control (1882-1899) have made it clear that the action of birds and mammals preying on the cockchafer was wholly insignificant. On the other hand, the physical conditions of the forest are unfavourable to the propagation of *Boltrytis tenella*, the artificial distribution of which has even been attempted. Recourse has also been had to collecting the larvae, capturing them in holes and plant traps, and destruction of the larvae in the ground, either by benzine and carbon bisulphide or by allowing pigs to grub, but all these methods have proved inadequate.

The present forester, Herr PUSEK, who took up his duties in 1899, proposed to destroy the cockchafers direct, by a new process based on the fact that at the time of flight and mating cockchafers exhibit a marked preference for certain trees growing in the open field and allowing of easy flight around and in their tops. These trees, in inverse order of importance are: the oak, the birch, the hornbeam, larch and beech.

In the course of felling work, isolated trees or groups of trees with good sun exposure and with plentiful foliage are left standing in order to attract the cockchafers at the time mentioned. These trees are called "Saug-

baumé" ("attraction trees"). They are of small size but provided with a well-developed top, the groups being called "attraction groups."

Where the forest consists of conifers and deciduous trees, the formation of such groups or isolated trees presents no difficulty. It is very difficult, on the other hand, in forests composed of deciduous trees exclusively. In that case partial success is all that can be hoped for.

The forest is divided into sections of 741-688 acres. The capture of the insect in the different sections is entrusted to "capture gangs" of 7 persons each. One of them is the ganger responsible for the results of the work, another shakes the tree, a third carries the cloth and receptacles for capture, and the 4 others, mostly girls, stretch out the cloth beneath the tree shaken.

The cockchafers falling on to the cloth are placed in a large receptacle in which they are killed by carbon bisulphide (0.10 oz of CS_2 per gallon of cockchafers). They are afterwards used to make manure.

The number of gangs per section varies according to the quantity of cockchafers. In 1903 Puster used 15 to clear 741 acres of forest, in 1907, 30 for 4128 acres in 1911, 52 for 4330 acres and in 1915, 42 for 4330 acres.

The success of the work depends chiefly on the ganger. The latter must determine the time when the control operations are to be begun; he selects his workpeople himself and sees that the work is properly done. At the time of flight he must, especially in the evening, go over his section every day to ascertain where the cockchafers have settled and make the necessary arrangements for their capture the following morning. The insects are gathered at least once a day.

As regards the number of cockchafers destroyed by this method, the writer gives the following figures:

	1903	1907	1911	1915
Area treated in acres	741	4128	4330	4330
Cockchafers captured in millions	7.12	18	22	14

The increase in the cockchafers captured up to 1911 is due chiefly to the increased area and improved technique of control.

Assuming that among the 22 million insects destroyed in 1911 there were 10 million females capable of laying 50 eggs each (which is much below the average), 500 million larvae were destroyed with them. Considering, furthermore, that the larvae eat for four years, and that one of them may easily destroy several young trees, it is evident that thanks to the method above described, though it may not have been possible to rid the forest of cockchafers entirely, very valuable economic results were nevertheless secured, as it became possible to work the forest on the right lines.

Herr PUSTER at the same time tried to prevent oviposition in the nurseries, where the larvae of the cockchafer work immense havoc. He ascertained that 2 larvae per 11 sq. ft. (in their third year of development) are sufficient to destroy all the young plants of a nursery. Collecting the cockchafers in the woods around the nurseries is not sufficiently effective. On

the other hand, when no rain falls during the period of flight of the insect, excellent results are obtained by covering the soil with quicklime (16 cwt per acre). When it rains, the females pass through the layer of lime and make their way into the ground to oviposit. If the lime is spread immediately after rain, it becomes ineffective. Evidently, therefore, the success of the method depends first and foremost on the weather.

Trial is now being made of naphthaline, the effect of which is apparently independent of the weather for its success.

The expenses entailed by cockchafer control in the "Bienwald" forest are relatively inconsiderable. They were, in 1903, 4.62 d., in 1907 5s. 7d., in 1911 4s. 7d., and in 1915 4s. per acre approximately. The chief items of expense are the collection and carting away of the insects, the cost of purchasing implements being very small. In consequence of these control measures the value of the forest has increased nearly £4000 per annum.

711 Destruction of the Tobacco Beetle (*Lasioderma serricorne*) (1).

MACKIE D. B. in *The Tropical Agriculturist*, Vol. XLVI, No. 3, pp. 170-171. Peta deniya, Ceylon, March 1916.

The methods now used for the destruction of the tobacco beetle do not meet with great favour for several reasons; a process of treating the finished product in a purely mechanical way without disinfectant is therefore greatly desired. In order to develop a method of this kind, the effects of cold and heat were studied, but as they yielded no practical results, attention was given to a vacuum method.

For the purpose of experiment, a small metal chamber was constructed having a cubic content of $4\frac{1}{2}$ cubic feet, fitted with a vacuumeter, the pump being operated by a small electric motor developing $\frac{1}{3}$ HP. In the first experiment tobacco beetles in all stages were placed in test tubes, which were put in the vacuum chamber, and the air exhausted to a point where the vacuumeter registered $27\frac{1}{4}$ inches. With the atmospheric pressure removed, the cellular tissue of the insects expanded, causing them to become greatly distended and producing a corresponding reduction in their vitality. However, despite the fact that the insects were held subject to these atmospheric conditions for periods up to and including three hours, many of them still showed signs of life, and immediately became active on the restoration of normal atmospheric conditions. In a second experiment insects were subjected to $27\frac{1}{4}$ inches vacuum, after which carbon bisulphide gas was introduced into the chamber and the vacuum reduced to about 16 inches. This treatment apparently killed all the insects. In a third experiment, more or less a continuation of the second, the gas was in turn removed from the chamber by pumps and ordinary atmospheric conditions restored. It was found that the cigars retained no odour or trace of the carbon bisulphide. In a last experiment to determine whether or not the cigars are mechanically or chemically affected by the combina-

(1) See *H.*, November 1914, No. 1054.

tion of the vacuum and gas, it was found that after a long exposure the gas in question tarnished all gold lettering on the bands and labels, but that the time required effectually to destroy the insect life in the cigars was considerably less than that required to affect the coloring of the labels.

The method contrived by the Author presents the following advantages over those now in vogue :

1) The treatment in no way interferes with or delays the regular routine work of packing or handling the cigars and other products ; 2) it reduces the period necessary to kill the beetles to about $\frac{1}{2}$ of that necessary under the old method, the results being at the same time much more thorough than on the old method ; 3) manufacturers can treat a practically unlimited quantity of cigars daily ; 4) the cigars being treated in their ultimate containers, are not exposed to further infestation from the pest, thus obviating the necessity for specially constructed store rooms ; 5) the noxious gases generated during the treatment are entirely disposed of by the pumps.

Alongside these manifold advantages the method has the disadvantage that it requires double fumigation to absolutely guarantee the product to be free from the pest in all forms.

712 - *Calocoris angustatus*, a Capsid injurious to Sorgho and other Gramineae in India. — BALLARD E., in *American Research Institute, Paris, Bulletin* No. 55, 6 pp., 1 Pl., coloured, Calcutta, 1916.

Calocoris angustatus Leth. (fam. *Capsidae*) is common throughout South ern India and constitutes one of the worst pests of " cholam " (*Indragon Sorghum*). Other Gramineae are also attacked such as Cumbu (*Pennisetum typhoides*), Themai (*Setaria italica*), Maize (*Zea mays*) and Abyssinian Grass (*Eragrostis abyssinica*), but only to a smaller extent. The adults appear as soon as the young ear heads begin to show, and oviposit under the glumes or in the centre of the floret. By the time the ear heads are free, they contain numbers of young nymphs of the orange red colour characteristic of the first immature stages. The most damage is done when the grains are in the " milk " stage, the sucking of the numerous nymphs causing the grain to shrivel and often the whole ear head to become dry and blackened.

Eggs are only laid in young and immature grains, fertilised grains never being chosen. Each female lays from 150 to 200 eggs, depositing from 1 to 16 in each flower. The eggs, which are usually laid at night, hatch out in from 5 to 7 days. The nymphs moult five times, the first moult occurring 3 days after hatching, and the rest usually every two days. The transition from eggs to adult requires between 15 and 17 days. It is possible that there are two generations on one crop of cholam, as all the ears do not ripen at the same time.

Attempts to control the pest by means of natural enemies have been unsuccessful, though the adults, when kept under laboratory conditions died from a bacterial disease.

It is suggested that the bugs contracted the disease from the ear heads.

on which they fed. Experiments on the bacterial disease were not carried out in detail, though in breeding cages it proved highly contagious. The nymphs were never affected and the disease seemed confined to the adults.

Similarly, artificial methods of control (spraying; shaking the ear heads over water covered with a film of kercsene; immersing the heads in Kerosine emulsion, traps with lights, were either inadvisable or impracticable. It is probable that the desired remedy will be obtained by some purely agricultural method or by taking advantage of some tropism. A simple and efficacious remedy is still to be found.

713 ***Agrotis segetum*, Beet and Potato Pest in Germany.** LÜSTNER in *Amtsblatt der Landwirtschaftskammer für den Regierungsbezirk Wiesbaden und Zeitschrift des Vereins nassauischer Land- und Forstwirte*, 97th Year, No. 37, pp. 277-279. Wiesbaden, 1915.

The caterpillar of *Agrotis segetum* occasioned widespread ravage in beet and potato fields in Germany during 1915.

The young beets were often gnawed away to such an extent that hardly anything of the root remained.

The potatoes were also gnawed, and where the fields were heavily infested it became impossible to use the tubers for human food.

The writer thinks this invasion to be an abnormal phenomenon, related possibly to the long period of drought during the spring and summer of 1915. The drought having destroyed a large amount of their ordinary food, the caterpillars were compelled to attack the beets and potatoes. Probability is lent to this view by the fact that the constitution of the roots and tubers is such as to provide the caterpillars at the same time with a water supply. In one locality the caterpillars disappeared completely from the potato fields after a fall of rain.

714 - **Nature of the Damage caused by the "Pink Boll-worm" (*Gelechia gossypiella*) to the Cotton Shrub in Egypt.** - GEORGE LEWIS, in *Ministère de l'Agriculture, Egypte, Service technique et scientifique, Section d'Entomologie*, Bulletin No. 2, pp. 1-8, Cairo, 1916.

A study of the nature of the damage caused by *Gelechia gossypiella* Saund. to the bolls of three varieties of cotton: "Affi-Assili", "Nubari" and "Sakellarides". Second-crop material was used for study. For each test 100 healthy bolls were chosen and compared with 100 infested bolls taken from the same plantation.

The results obtained may be summed up as follows:

1) The percentage of fibre is reduced in the bolls attacked by the microlepidopteran.

2) In almost all cases there is a very considerable diminution in the number of seeds developing in an infected boll as compared with a healthy one. The reason may be the complete destruction by the insect of a number of seeds while still very small.

3) In the infested bolls, furthermore, a diminution in weight of the healthy seeds individually is found, which may in extreme cases amount to 26 %.

4) In these seeds reduced vitality is also observable. Their germination capacity may drop to one half of that of the seeds of healthy bolls.

5) The quantity of fibre and seed in the infested bolls is never equal to that of the healthy ones. In the worst case examined it was only one fourth, and not more than three fourths in the most favourable case, as compared with that of the control specimen.

715 - *Zelleria oleastrella* and *Glyphodes Unionalis*, Lepidopterous Pests of the Olive Tree in Apulia, Italy. MARFELLI GIOVANNI in *Rivista di Entomologia*, *Atto di Zoologia generale e agraria della R. Scuola superiore di Agricoltura e Foreste*, Vol. X, pp. 80-102. Portici, March 2, 1916.

During the spring and summer of 1915 the writer was instructed to undertake control tests against *Prays oleella* F. ("tunnelling caterpillar" of the olive tree) and *Rhynchites ruber* Fairm. at Novoli (Lecce). He was also to study insect pests of the olive tree which he might encounter in this region. He was thus enabled to observe the habits of two lepidoptera infesting the olive tree, namely *Zelleria oleastrella* Mill. and *Glyphodes unionalis* Hb., with which he deals in this article.

1) *Z. oleastrella* Mill. - The adult makes its appearance in March and April, fluttering at twilight round the leaves of the new bushy shoots at a height rarely exceeding 2 metres. Mating takes place after sunset and the female next oviposits on the upper or underside of the more or less leathery leaves (never the very soft leaves), or along the green offsets of the shoots which have developed during the season. The egg hatches a few days after laying, and the young larva makes its way towards the leaf-stalk if born on the leaf, or climbs up quickly to the end of the shoot to take up its quarters in the soft terminal leaves whether detached from the growing point or not. Here it penetrates to the growing point itself, gnawing and devouring it inside, or else it remains on the upper surface of a young leaf, weaving a few sparse threads around it. At times, without leaving the coriaceous leaf on which it was born, or else making its way, especially in winter, to the small leaves at the end of a twig, the larva cuts a small hole in the upper face of the leaf and penetrates under the cuticle, where it digs a tunnel of variable length and irregular shape, and feeds on the mesophyll.

When more fully grown, it discontinues tunnelling, and directly devours all the green parts of the plant, piercing the leaves and the leaders.

It passes into the pupal stage in a cocoon made of very strong threads, and emerges in the perfect state after a period of from 12 to 20 days.

It follows from what has been said above with regard to the feeding of the larva that it may become injurious when it attacks the new shoots of topped olive trees, young plants permanently transplanted and nursery plants. In the latter case in particular the insect is especially injurious, not only destroying the leaves, but also detaching the growing point of the leader, compelling the latter to put out new side twigs, which gives the plant an abnormal form.

As a means of larva control, arsenate of lead in paste with 1% of water is advised. Spraying is carried out in March and April with the or

dinary mildew sprayer, the jet of which furnishes exceedingly minute droplets. The first spraying may be followed by another ten days later.

Among the natural enemies of *Zelleria*, the writer mentions a dipterous, *Phytomyptera nitidiventris unicolor* Rond. and some hymenopterous parasites of the larva, belonging to the families *Braconidae*, *Ichneumonidae* and *Encyrtidae*: *Apanteles* sp., *Angitia* sp., and *Agonaspis fusci-collis* var.

2) *G. unionalis* Hb. — The adults make their appearance in March and April. Mating takes place at night, and the fertilised females lay their eggs one by one on one of the faces of the olive leaf, or even on the green twigs of the tree. The larvae on hatching provide themselves with a shelter by means of a thin tissue of silken threads, forming with the leaf a sort of wide channel or tube open at both ends.

Some hours after construction of this shelter the larva begins to feed gnawing and devouring the leaf parenchyma and the tissue beneath it, it thus reaches the epidermis of the opposite side, but without breaking into it.

Becoming stronger, the larva gnaws away the entire leaf including the softest part of the midrib, and sometimes also the twig stem. Hence, in case of serious infestation, small twigs are found with their end broken away and residues of leaves, i. e. leaf-stalks and pieces of midrib with fragments of the base of the leaf.

The same means of control are advised as for *Zelleria*, namely spraying with arsenate of lead as a paste containing 1 % of water.

Among the natural enemies of *Glyphodes* there is included one of the Braconidae of the genus *Apanteles*, which is not yet clearly determined, and a Dipterous, *Nemorilla notabilis* Meig., preying on the larva.

716 **The Catalpa Sphinx (*Ceratonia catalpae*), a Lepidopteron infesting *Catalpa Catalpa* and *C. speciosa*, in the United States.** — HOWARD L. O. and CHITTENDEN F. H. in *United States Department of Agriculture, Farmer's Bulletin* 705. 9 pp., 3 fig. Washington, D. C., February 10, 1916

The common or eastern catalpa (*Catalpa Catalpa*) and the hardy or western catalpa (*C. speciosa*) are comparatively free from insect attack in the United States. Such common shade tree pests as the bag worm (*Thyridopteryx ephemeraeformis* Haw.) (1) and fall webworm (*Hyphantria cunea* Dru.) feed on the leaves, but apparently do so only in the absence of more palatable food. One insect, however, the larva of *Ceratonia catalpae* Bdv., feeds normally and exclusively on the foliage of these trees, and in some seasons does very considerable injury, often completely stripping the leaves from individual trees, and sometimes an entire grove.

Owing doubtless to the increased planting of these trees outside the region where they are found in the wild state, this insect has extended its natural range, and its injury is more widespread than formerly. It is strictly a North-American species, common in Virginia, Maryland and Ohio; in 1888 its range was from Virginia to Florida, westward to the Mississippi

(1) See B. April 1916, No. 485.

and as far north as Indiana; of late years it has extended its range northward on the Atlantic coast as far as Pennsylvania, and westward to Oklahoma and the Missouri.

The insect appears suddenly in a locality in large numbers and then disappears for years. Its eggs are laid in masses of about a thousand; the young larvae feeding in groups for some time. The larvae moult four times. In the extreme south the insect is found in all stages during the summer and there are three or four generations a year. Each generation lives about 6 weeks (in Florida); around Washington there are two generations annually.

A number of parasitic insects attack and kill *Ceratomyx catalpae*. Among them *Apanteles congregatus* Say is very common and widespread through the eastern States; unfortunately it is in turn attacked by two parasites (*Mesochorus aprilius* Ashm. and *Hemiteles mesochoridis* Riley MS.) but they are not so abundant as to prevent the beneficial parasite flourishing. (*Apanteles*) *Microplitis catalpae* Riley, which appears to be especially a parasite of the genus *Ceratomyx*, also attacks this species. It is in turn attacked by parasites: *Hypoperomastus tabacum* Fitch and (*Heliophila*) *Horismerus microgastri* Ashm. Finally the larvae of *C. catalpae* are attacked by two species of tachinid flies: *Phorocera claripennis* Macq. and *Frontina frenchii* Will. A few birds, including the cuckoo, the catbird (*Calococcyx carolinensis*) and the Baltimore oriole (*Icterus galbula*) prey upon *C. catalpae*. There are several methods by which *C. catalpae* may be readily destroyed: gathering by hand, spraying with arsenical poisons, destruction of the pupae by spading the ground around the tree trunks in autumn, and by protecting the parasitic insects which attack it. The second is often the most practical method. *Catalpa* plants being frequently attacked by leaf spot (*Phyllosticta Catalpae*, etc.) and other similar diseases, arsenical spraying should be combined with Bordeaux mixture. The following proportions are advised: 6 lbs. blue vitriol or bluestone and 4 lbs. of fresh stone lime to 50 gallons of water (Bordeaux mixture). To this 1 lb. of Paris Green or 3 lbs. arsenate of lead are afterwards added.

717 - The Parsnip Webworm (*Depressaria heracliana*), an Insect Enemy of the Parsnip, in Canada. - LORRIS W. D. and GOODRICH C. B. in *The Canadian Entomologist*, Vol. XLVIII, No. 3, pp. 37-41, 3 Fig. Pl. II. London: February, 1916.

Since the summer of 1914, *Depressaria heracliana* Dec., which usually confines its attacks to the wild parsnip (*Heracleum lanatum* Michx.) began also to damage the cultivated parsnip (*Pastinaca sativa*) in the vicinity of the Agricultural College of Truro.

The larvae of this insect bore through the sheath and penetrate to the young flower buds inside. Here they commence to feed, eating away and destroying the greater part of the buds. When the head bursts open the larva crawls down the leaves and stem. It feeds the green parts of the plant until it passes into the pupal stage within a light cocoon of silk and excrement. The adult emerges during the latter half of August and passes the winter beneath the bark of trees.

This insect has, in addition to the vicinity of Truro, been reported in

Hants and King's Counties, in New Brunswick, and outside Canada, in England, Scotland, Ireland, Germany, Sweden, Finland, France and the United States. It not only attacks the cow parsnip [*Heracleum lanatum*] and the cultivated parsnip (*Pastinaca sativa*), but also the wild carrot (*Daucus carota*), *Heracleum spondylium* and *Heracleum sibericum*.

Among natural enemies there are known in Europe: *Cryptus flagellator* Grv., *Pimpla heraclei*, *Hoplismenus dimidiatus*, *C. profligator* Gr. and *Ophion vulnerator* Grv.

Many larvae and pupae are destroyed by a bird, the hairy wood pecker (*Picus villosus*).

At Truro a number of hymenopterous parasites have been reared from this insect but are not yet determined.

The habit of the larva of passing a great amount of its life hidden amid seed-heads makes the control of this pest very difficult. Spraying with arsenate of lead or Paris green just as the larvae were hatching had little apparent effect. Dusting with Paris green or air-slaked lime gave better results. On the other hand, cutting off and burning affected seed heads, as has been suggested, would result in the destruction of the entire crop in places where the infestation is as severe as in the Truro district.

718. — **The Cherry Leaf Beetle (*Galerucella cavicollis*) a Fruit Tree Pest, in the United States.** — HERRICK GLENN W. and MATHESON ROBERT in *Journal of Agricultural Research*, Vol. V, No. 20, pp. 943-946, Pl. LXIV-LXV. Washington, D. C. February 11, 1916.

The cherry leaf beetle (*Galerucella cavicollis* Lec.), reported by Davis as destroying the foliage of cultivated cherries at Bellaire, Mich., during the summer of 1894, has gradually spread and attacked other fruit trees (peach and *Prunus* spp.). During the summer of 1915, the outbreaks and the damage caused by these insects, which defoliated their hosts, assumed alarming proportions, particularly in the State of New York.

In June and July the pest was reported from the following places: Sonyea (cherry and peach); Collins, Gowanda, Wyoming, Jamestown

In June and July the pest was reported from the following places: Sonyea (cherry and peach); Collins, Gowanda, Wyoming, Jamestown Chautauqua County, Elmira, Ithaca (cherry and peach); Kennedy, Fredonia, Ripley (plum and peach); Perry, Scio, Olean, Honeoye Falls, Batl Holland, Perrysburg, Castile and Hornell (cherry).

So widespread an outbreak of this insect is probably due to the favorable weather conditions, which allowed of hibernation with little loss of life. The larvae of the beetle live on the native host, the *Prunus pennsylvanica* ("pin cherry"), not attacking cultivated fruit trees, and when artificially transferred to the latter they die off in large numbers.

As a means of control lead arsenate (paste) at the rate of 4 to 5 lbs to 100 gallons of water is recommended; good results have also been obtained with nicotine.

Morphology and Biology of the Green Apple Aphid (*Aphis pomi*), in the United States.—BAKER, A. C. and TURNER, W. *Trans. Entomol. Soc. Amer.*, Vol. V, No. 24, pp. 955-963. 1928. (Pl. LXVII-LXXX. Washington, D. C. 1928. Pp. 24, 1919.)

Owing to the abundance of the green apple aphid (*Aphis pomi* De Geer) at all times, in most apple-growing regions, and the serious outbreaks of the species, experiments were begun at the deciduous fruit insect laboratory at Vienna, Va. in 1914-15, in order to study the embryology of the insect, to explain the high mortality of the eggs in certain cases, their wintering condition, and the most suitable time to attempt their destruction.

The stem mothers feed only on the exposed green of bursting buds and tiny leaflets; later generations preferred the leaf petioles, and then the young newly formed twigs. They avoid the leaves themselves, above all when excessively tiny. Later, when the twigs commence to harden, the aphids migrated back to the underside of the leaves, where they are found in fairly large colonies.

This selection of food occurred only when the numbers were comparatively small. In case of excessive infestation, twigs, leaf petioles and the underside of the leaves are attacked simultaneously.

One of the most striking symptoms of the attack is the curling of the leaf in the spring and the first half of summer. Contrary to supposition the aphid never attacked the apple fruit during these experiments.

When furnished with a tender, succulent food during larval life, the adults are large, plump and light green in colour. On the other hand, if the food is poor in quality, the adults will be smaller, dark green, and the bodies will be much wrinkled. The insect will also require a considerably longer period to attain maturity.

The eggs laid in the autumn on the tender twigs of the apple develop rapidly for a few days, after which they rest for the winter. When the formation of the embryo is completed in the spring, an increase in temperature will cause the eggs to hatch. Before this, a high temperature only tends to destroy it.

The stem mother is wingless, and produces summer forms both winged and wingless, the former predominating. Mating commences toward the close of September, and the fecundated eggs are laid at the ends of twigs as stated.

A. pomi was first mentioned by De Geer in 1719, in Sweden, and has been successively reported and described by various writers in all parts of Europe, Turkestan (Asia), and the Orange River Colony (Africa).

It certainly made its appearance in the United States as far back as 1881, in the State of Washington and the district of Columbia. It was reported in 1894 at St. Louis, and in 1897 in Illinois. It is now common where ever the apple tree is cultivated.

In Canada it abounds in all provinces from Nova Scotia to British Columbia.

In America, just as in Europe, really serious and injurious outbreaks occur at various intervals. In 1911, Virginia sustained heavy damage.

Effect of Food on Rapidity of Development and Reproduction of Aphis pom.

Experiment No.	Poor food, insects small			Good food, insects large			
	Date born	Final period	Number of young produced	Experiment No.	Date born	Final period	Number of young produced
1559	Aug. 5th	10 Days	15	1617	Aug. 13th	7 Days	—
1613	Aug. 14th	10-12 "	8	1687	Aug. 19th	7-8 "	28
1645	do	10-12 "	14	1839	Sept. 1st	7-8 "	20
1486	July 28th	11-13 "	41	1751	Aug. 21st	7-8 "	25
1660	Aug. 17th	12-13 "	—	1807	Aug. 27th	7-8 "	25
1852	Sept. 10th	12-14 "	—	1850	Sept. 2nd	8-9 "	23
Average . . .	—	11.5	10.25	—	—	7.7	24.2

In 1912 the States of New England and New York were ravaged by the insect. There are, however, some parts where the insect is constantly present and injures the crops every year, such as Colorado, for instance, where it is rightly regarded as one of the worst orchard pests.

Appended is a list of 19 publications.

120 *Platypus wilsoni*, a New Species of Coleopteron Attacking Coniferous Trees in British Columbia. SWAINSE, J. M. in *The Canadian Entomologist*, Vol. XLVIII No. 4, pp. 97-100 with plates VI-VII. London, March 1916.

This insect is very abundant and injurious on the southern half of the coast of British Columbia. The adults excavate a cylindrical tunnel about 6 to 14 inches in length through the bark and directly into the wood of large and small trunks, in small trunks usually curving around the heart wood. A characteristic fungus always found coating the walls, and causing black stains, serves as food for the larvae, and to a lesser degree for the adults. Eggs, larvae and adults are found free in the tunnels. It attacks all conifers of the British Columbia Coast, with the exception of *Thuja* and *Chamaecyparis*, but is most abundant in *Pseudotsuga*, *Tsuga*, and *Abies grandis*. Dying or badly weakened trees and freshly cut logs are usually selected for attack, but standing trees with abundant green foliage are not infrequently affected. Frequently, this insect pest attacks the trees injured by ground fire. A tree attacked by *Platypus wilsoni* and by *Gnathothricus* is invariably beyond hope of recovery.

